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ECONOMIC GEOGRAPHY

APRIL

AGRICULTURAL SICILY
David G. Basile

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GEOGRAPHIC ASPECTS OF MILLER COVE
L. LeMar Stephan

RIBE
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LOCATION OF SALT LAKE CITY
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IMPERIAL TEXAS

TEXAS, an empire in itself, practically monopolizes that indefinable section of our land which we are wont to set apart as our near Southwest. It is an empire in extent, in population, in diversity and adequacy of economy, in relationships with every part of our country. It is an empire in its productive potentialities, in its wide range of resources and activities, in its future development of industry. Texas is an imperial state.

The history of Texas is a history of empire. Throughout the years of its struggle from wilderness to cultural eminence, Texas kept the vision of its imperial future as one of America's greatest and richest states constantly before its people, and they have responded by achieving for it from one decade to the next, from one generation to another, those things that have made it great and powerful in national affairs, a leader among the states. The people of Texas themselves are imperial in point of view, in realization of their destiny.

Its great plains and plateaus, its vast grasslands, its far-flung forests and fields of crops, its treasures of petroleum and ores and building materials, its broad horizons and continental storms, its number and variety of folk—all these are imperial in their significance and their effect. The thousands of miles that measure the distances from one boundary to the opposite, the extent of territory that lies between its borders, these are but the gauges of empire. Texas is imperial in all its purposes, in all its attributes. Texas is imperial in its prospect!

ECONOMIC GEOGRAPHY

VOL. 17 APRIL, 1941 No. 2

AGRICULTURAL SICILY

David G. Basile

IF agricultural pursuits were suddenly wiped off the surface of Sicily almost two-thirds of the four million inhabitants would be without an occupation, 94 per cent of the total area of the island (a little less than 10,000 square miles) would lose its covering of agricultural or arboreal growth, and, if we use the figures of 1934, more than three-fourths of Sicily's exports would be destroyed. Sicily has always been agricultural, for back in the time of the Greeks, the coastal plain and the lower mountain slopes on the north and east were being used for the production of foodstuffs. During the time of the Romans Sicily was one of the chief granaries of the Imperial City. Later came the Saracens who introduced irrigation, scientific agricultural methods and the cultivation of citrus fruits which have since become one of the mainstays of Sicilian economy.

However, Sicily is not the farmer's paradise that such figures would seem to indicate. Good evidence of this is the fact that Sicily leads all areas of Italy as a source of emigrants. Sicily, an island, located close to the "toe" of the Italian "boot" was formerly connected to the Italian mainland across the Straits of Messina. It was only in recent geologic times that the two were separated and that all is not yet quiet is indicated by eruptive Mount Etna on the northeastern coast. Uplift and tilting took place and this coupled with other geologic processes resulted in a rough and rugged terrain. The entire island of Sicily is hilly and fully two-thirds of its surface approximate one thousand feet in elevation. A steep and rugged range of mountains runs across the northern edge and then divides in the north-central part of the island. Part continues towards the east to the Straits of Messina and part branches off in a southeasterly direction and extends to Capo Passaro in the extreme southeastern portion of the Sicilian triangle.

These mountains affect agriculture unfavorably in that cultivation and the care of crops is made much more difficult. In fact, in many of the more densely populated areas of the northern coasts, terracing is employed. Moreover, the soil is quite apt to be thin and stony and subject to erosion. But there are favorable aspects also. The mountains are high enough to strip moisture from the air (between 3,000 and 6,000 feet in the northeastern part) so that these regions with their annual average rainfall of 30 to 40 inches have the greatest precipitation on the island. Numerous short and rapidly flowing streams are fed by this precipitation and they fur-

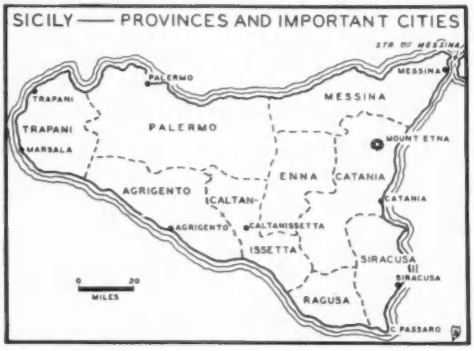


FIGURE 1.—Sicily, an island with an area of less than 10,000 square miles, has a population density of 404 per square mile, a figure which is exceeded in Europe only by Great Britain, Belgium, and the Netherlands. In area occupied, in occupations furnished, and in the percentage of total exports provided, agriculture is supreme and yet Sicily does not raise food enough to feed itself.

nish not only water for irrigation but also alluvial material for the allvuial fans at the base of the mountains. It is on these alluvial fans that most of the citrus trees, so important to Sicily, are located. Because temperatures are affected by the altitude of mountains, there is a distinct banding of the crops raised on them. Those requiring less severe conditions tend to occupy the lower slopes.

Climate, too, is very important and like the topography has its good and bad points. Sicily is a fine example of the Mediterranean type of climate which is characterized by a winter period of maximum rainfall and a summer period of almost drought conditions (Figures 2 and 3). Palermo on the northern coast has 30 inches of rainfall in a period of 112 days and Catania on the southeastern coast, 18 inches in but 46 days. The rest of the year is essentially a period of drought. Such a dry period is fine for the ripening of fruits and the maturing of grains.

Average rainfall conditions, however, mean little. If Catania is again used as an example (Figure 3) we find that in the period from 1926 to 1930 the yearly rainfall totals varied from 11.5 inches in 1926 to 35.5 inches in 1929. Rainfall varies from place to place, from period to period within the year and from year to year. There is always present the danger of drought throughout most of the island, not only from the variations that may occur in rainfall but also from the effects of the "sirocco" which is a warm, dry, dust-laden wind sweeping off the Sahara Desert when low pressure conditions exist over the Mediterranean Sea.

There are other limiting factors in Sicilian agriculture but topography and particularly climate are the most important. Others will be mentioned as we discuss some of the specific commodities raised.

If one were able to look down upon Sicily from a height sufficiently great to give him a perspective of the entire island, he would notice that Sicily is framed by a narrow coastal plain rarely more than ten miles wide. This coastal plain and portions of the lower mountain slopes are covered with the green of citrus trees, of olive trees and of the vine. Here are to be seen the greatest density of houses, railroads, and roads. This is the most prosperous zone and contains fully one-third of the total population (512 per square mile as compared with 156 for the island as a whole). The interior, however, is quite devoid of cultural features. This is the drier region characterized by the large landholdings known as the "latifondi" and for the most part few evidences of habitation are visible, but here and there, like oases in a desert, appears a spot of green revealing a zone of intensive cultivation about some little town or settlement. This rugged and arid interior region is more suitable for the cultivation of extensive crops and from this interior region comes most

of Sicily's wheat (Figure 4). But not all of the land, by any means, is covered with wheat. Some of it is pasture and more is covered with wild brush. Sicily has a palatable and well-flavored exterior but an interior that is, in comparison, tasteless and hard to utilize.

A glance at the maps showing the different agricultural areas of Sicily (Figures 4, 5, and 6) will quickly reveal the coastal fringe of intensive cultivation. By far the most important from the point of view of value is the citrus fruit industry which includes the raising of lemons, oranges, tangerines, and limes. In 1934 citrus fruits and citrus fruit derivatives provided almost 40 per cent of the total value of Sicilian exports and yet the area devoted to their production was only 2 per cent of the cultivable and forested land of Sicily.

Because the citrus fruits in general and the lemon in particular require warm temperatures and plenty of moisture, they are found on the northern and eastern coastal plains and on the lower slopes of mountains—the zones of most abundant moisture both from rainfall and streams. Not only are the mountains characterized by greater precipitation and numerous streams but also by a great number of springs. The porous limestone structure of many of the mountains permits the absorption and retention of rainfall which later issues forth as springs which are used for irrigation during the dry period when streams and rainfall are insufficient. Citrus fruits and irrigation projects are always found together.

Because of the low latitude of Sicily and the ameliorating effects of the ocean, the temperature is very steady and the difference between the warmest and coldest months—July, 80 degrees and January, 52 degrees—is little more than 25 degrees. Snow and frost, both of which are harmful to citrus trees, are quite rare.

Both oranges and lemons are produced in large quantities (in 1936 the

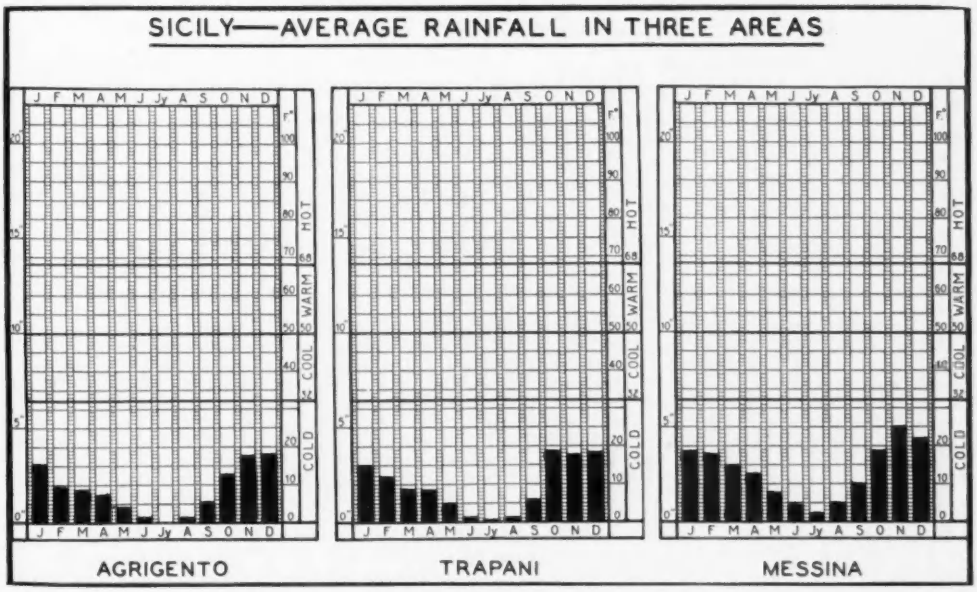


FIGURE 2.—These rainfall charts, as well as those of Figure 3, show clearly the winter rain and summer drought periods characteristic of the Mediterranean climate. Southern Sicily as typified by Agrigento, has a 20-inch rainfall average, whereas in northeastern Sicily, as at Messina, the average is 32 inches and in western Sicily, 22 inches. (Data: *World Weather Records*, Clayton.)

production of each exceeded 10.8 million boxes) but the orange trade has declined considerably because of competition from Spain and Palestine. Since the lemon is the most important single crop of the island and since citrus cultivation in general is quite similar, we shall use the lemon as a specific example.

Italy leads the world in the production of lemons although since 1935 California has been a very close second, and once—in 1937—actually surpassed Italy. Ninety per cent of the Italian production comes from Sicily and two-thirds of Sicily's production comes, or did come until the recent appearance of the disease known as "mal secco," from the provinces of Catania and Messina in the northeastern corner of the island where strips of loose, sandy soil suitable for lemon production are found. Lemon trees are planted 20 feet apart in small groves so as to allow plenty of room for the roots. Careful attention, pruning, and watering are essential. Because the lemon is very sensitive to frost it is located on the lower slopes of mountains up to 1,500 feet. The more hardy orange occupies the zone from 1,500 feet to 3,000 feet. Each lemon tree yields continuously so that there are flowers on the branches along with the fully ripened fruit, but generally harvesting takes place from October to December. Each tree yields approximately 1,000 fruit which are carefully clipped from the tree by hand and packed in boxes. Profits, after deducting fertilizer and labor costs, are often 200 dollars per acre and this accounts for the somewhat higher living standards of the people in the citrus areas.

Lemons are relatively easy to export because they keep well and do not damage easily and so Sicily is able to send lemons all over the world. Sicily, however, has suffered from the competition of the California lemon growers because the United States market, formerly Sicily's third best, is now largely supplied by them instead of by Sicily. Since the greatest demand for lemons comes during the summer months, the Sicilians have tried to develop the early summer ripening of the fruit. The roots of the trees are exposed to the air during the dry period and irrigation is halted. In early autumn fertilizer is applied and the roots covered after which they are carefully watered. This treatment causes a crop of lemons to ripen in July and the trees do not seem to be harmed. Most of these forced-culture lemons come from Catania on the east coast.

Besides the fresh citrus fruits, Sicily produces various derivatives such as lemon juice, lemon and orange essences, citric acid, and candied and salted peels largely for export purposes. There has been a decided downward trend in the export of such products since 1929 for then the citrus fruit derivative exports represented 11 per cent of Sicily's total exports by value whereas in 1935 they represented but 4 per cent. This is probably a result of competition from other producing areas such as the United States.

A second important intensive crop is the vine. During the four-year period 1933–1936, the yearly average production of grapes was about 550,000 metric tons or about 9 per cent that of the kingdom. As Figure 5 indicates, the vine is well dispersed over the whole of the island but in the northeast and northwest corners are two zones of major importance producing two-thirds of the grapes of Sicily and about 6 per cent of those of all Italy. Some table grapes are raised in Trapani and Palermo but most of the product is converted into the cheap, low-grade wine used for local consumption. There is also a con-

siderable export of Marsala and Mascali wines from the regions about Trapani and Mount Etna respectively where exist peculiar soil conditions which give these wines their unique flavor. Because the vine can be grown up to 3,300 feet in this area, the rich lava soils of Mount Etna may be used.

The climate is quite important in vine culture. Without the characteristic dry season of the Mediterranean climate, the juices would not become concentrated and rich in sugars—conditions needed for good wines. Rains during the ripening and maturing period tend to dilute the juice and the wines produced from such grapes are of inferior quality. Ordinarily where the climate is not too dry, the vines are trained along the lower branches of olive trees or else are suspended on wires, but where the dry period is too prolonged as in the more southern regions of Sicily, the vines are often placed in trenches where evaporation is less pronounced.

The cultivation of the olive is not so intensive as that of the two previously mentioned products, but in certain small areas on the northern and southwestern coasts (Figure 6) there are carefully tended groves of olive trees whose cultivation may be considered intensive. In 1936 three-fourths of the 852,000 acres used in the production of olives was used for the so-called "promiscua" cultivation of olives—i.e., olives were interplanted with other crops or were considered more or less as "side-line" crops. The olive can well stand the dry seasons of the Mediterranean climate because of its protective bark and the small glossy leaves which retain moisture within the plant. Because it requires less water than many other crops and will thrive on thin, stony soils and on steep slopes, olive cultivation is widespread and fully 14 per cent of the total forested and agricultural land of the island is used for this purpose.

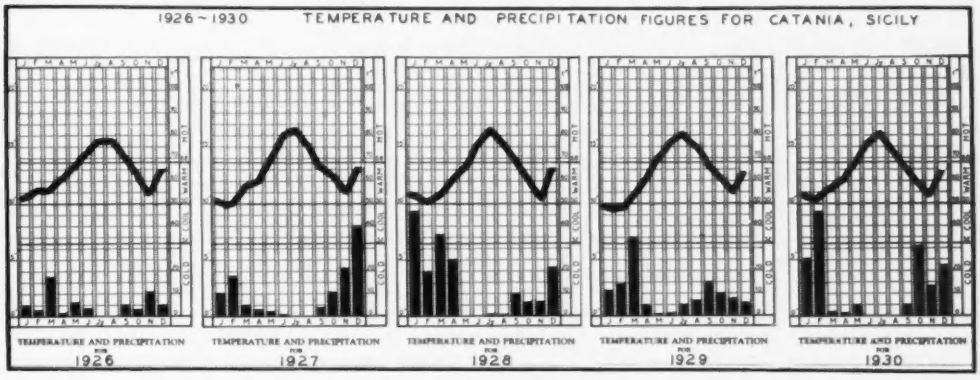

1926~1930 TEMPERATURE AND PRECIPITATION FIGURES FOR CATANIA, SICILY
J F M A M J J A S O N D
HOT
WARM
COOL
COLD
TEMPERATURE AND PRECIPITATION FOR 1926
TEMPERATURE AND PRECIPITATION FOR 1927
TEMPERATURE AND PRECIPITATION FOR 1928
TEMPERATURE AND PRECIPITATION FOR 1929
TEMPERATURE AND PRECIPITATION FOR 1930

FIGURE 3.—Not only is the rainfall of Sicily characterized by its seasonality and its small amount, but also by its fluctuation from year to year. Rainfall totals for Catania during the period 1926–1930 were 11.5, 22.4, 35, 22.4, and 30 inches respectively. (Data: *World Weather Records*, Clayton.)

The map showing the areas of olive production (Figure 6) brings out clearly four distinct zones of major importance; the northern coast of the provinces of Palermo and Messina, the coastal portions of Catania, the southeastern corner of the country in the provinces of Ragusa and Siracusa, and finally, the zone in the western end of the island in the provinces of Agrigento and Trapani. Figure 6, which shows the areas where

olives are grown, does not give a very true picture of the quantities produced in the different areas, as the following chart will indicate. The largest pro-

Areas of Olive Production	*Percentage of Total Acreage in Olives (1936)*	*Percentage of Total Production (1933–36 average)*
Ragusa–Siracusa...	14	15.7
Agrigento–Trapani.	17.4	32.9
Palermo–Messina..	25.6	18.6
Catania.....	32.6	15.3
	Represents 89.9% of the area in olives	Represents 82.5% of the total olive production

ducer of olives is the Agrigento–Trapani region whereas the smallest producer is that in Catania even though it ranks first in acreage. This is due to the fact that in the former province there are more intensively cultivated groves than in Catania which contains almost entirely the "promiscua" culture. The "promiscua" production per acre is generally one-third that of the "specializzata" or intensive type of olive production.

The centers of greatest olive production are also the centers of population for although but little care is needed by the olive tree itself, once it becomes established, large amounts of labor are required for picking the fruit, the best grades of which are carefully picked by hand. Approximately one-third of the total population of the island is located on the fringe of coastal plain only 7 to 10 miles wide.

Because of the scarcity of animal fats and also because such fats would not keep well in this climate, most of the olive crop is used for oil. The average annual production of oil during the period 1932–36 was well over six million gallons, which is 11 per cent of that produced by the kingdom.

There are other tree crops of considerable importance, in fact Sicily is a very good example of a region making extensive use of its tree products. The most important include the almond, the pistachio, the chestnut, and the hazel nut. Of these the almond is of greatest importance and during the period 1923–28 some 3.5 million pounds were produced annually, most of which were exported. The carob, whose fruit furnishes fodder for livestock, and the mulberry, which supplies food for the few silkworms Sicily has, are others. With the exception of the mulberry and the chestnut, these crops are produced in the dryer regions of south-central Sicily. Although they are tree crops as are the citrus fruits and olives, the almond, pistachio, etc., are not quite so intensively grown as are the citrus fruits.

In the interior are found the sown crops which occupy fully 62 per cent of the cultivable and forested area of Sicily. Wheat and the fava bean are the most important of these sown crops, in fact between them they account for more than 40 per cent of the total cultivable area.

Fave production is very closely associated with that of wheat because this leguminous plant with a seed much like a large lima bean is used to enrich the soil prior to the planting of wheat. The 27 per cent decline in the production of fave from the period 1923–28 to 1932–36 is due to the tremendous expansion in wheat resulting from the "Wheat Campaign." The increased acreage of wheat is partially at the expense of the fave acreage. The fava plant, besides being used for its enriching effect on soils, supplies food for the people and food and bedding for the animals. It is produced all over Sicily but the zone of greatest importance is in the limy, clay soils of the south-central part. Italy is the world's foremost producer of fave and in 1936, 40 per cent of its total was supplied by Sicily.

Wheat, the oldest and most characteristic product of the island, occupies, on the average, about one-third of the cultivable land of every province except rocky and forested Messina in the extreme northeast. However, the main area of wheat production is in the dryer interior. Here the climate is suitable for grain production because the rainfall, although rarely exceeding 20 inches per year, is generally sufficient for growth, and the warm dry season in summer is fine for the maturing and ripening of the hard wheat so important for the bread and macaroni of the native diet. Although, as was mentioned above, Sicily was one of the chief sources of wheat for Rome, now it cannot produce enough to feed itself let alone provide a surplus for the rest of Italy, for during the six-year period 1929–34 Sicily imported about 3.5 times as much wheat and wheat products as it exported. During the period 1932–35 Sicily ranked first in the kingdom in total acreage devoted to wheat but only ninth in the production of wheat. Why should an area so densely populated as Sicily show yields of 10 to 15 bushels of wheat per acre on the average whereas France averages about 30 bushels to the acre?

According to one authority climatic conditions alone would keep the wheat yields of southern Italy with a climate like that of Sicily about 20 per cent lower than those in the north which average over 20 bushels to the acre. The fact that fully five-sixths of the wheat crop of Sicily is grown on hilly or mountainous lands indicates that thin soils and the difficulty of cultivation and harvesting are further troubles to be contended with, and yet it is interesting to note that the greatest yields per acre are recorded in the mountainous areas rather than in the plains country—19 bushels as compared with

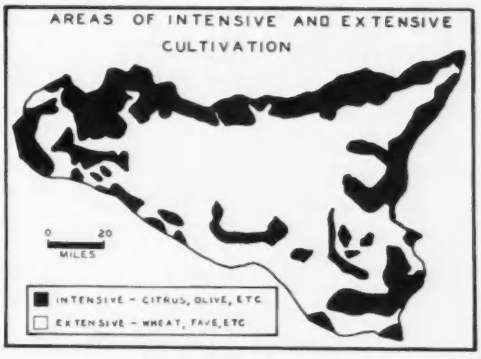


FIGURE 4.—The zone of intensive cultivation is characterized by crops such as the olive, citrus, and vine; by the greater density of houses, railroads, and roads, and by the fact that here lives fully one-third of Sicily's population. The zone of extensive cultivation includes pasture and forest lands as well as those devoted to the sown crops which alone occupy two-thirds of the cultivable and forested land of Sicily. (Derived from *Enciclopedia Italiana*, Vol. XXXI, p. 662.)

12. Perhaps this is a result of the greater amount of moisture available in the mountainous areas.

Thin soils, steep slopes, arid conditions, the fact that much of the wheat is planted between rows of other crops which provide too much shade for maximum wheat yields, have much to do with the low wheat yields but perhaps equally significant is the landholding system known as the "latifondo." The term "latifondo" is an Italian word used for the characteristic landholding system in Sicily and it is also the word used to designate a single establishment. "Latifondi" is the plural, meaning several such establishments. The "latifondi" are large, extensive properties of 500 acres or more located generally in the interior. Until recently nearly two-thirds of the total land area of the interior was under the control of the "latifondi" owners. In the province of Messina, where occur the greatest amounts of rainfall, the "latifondi" occupy only 19 per cent of the total area whereas in the semi-arid province of Caltanissetta some 42

per cent of its total area is so held. It seems then that the system is a response to the climatic features present, but in itself it sets up certain problems other than those induced by the climate which add to the difficulty of Sicilian agriculture.

These hereditary estates are quite similar to the haciendas of Mexico and until very recently comprised almost one-third of the total area of the island. As in Mexico, these estates were owned by very few people. Prior to the World War one-sixth of the area of Sicily was owned by 173 individuals and a recent figure reveals that 24 per cent of the area of agricultural properties is held by less than one per cent of the total number of property owners. In the matter of utilization the "latifondi" are again much like the haciendas for they produce chiefly the extensive crops such as wheat and cattle. The production of these two has occupied 53 and 29 per cent respectively of the land held by the "latifondi."

The "latifondo" is both a cause and an effect of the conditions found in interior Sicily. Semi-arid conditions would in themselves keep down yields and necessitate large landholdings in order to produce enough to support a few inhabitants. Besides this factor of low yields, the lack of drinking water and the prevalence of malaria, both a result of the drying up of most of Sicily's rivers during the summer months to form numerous pools of stagnant water, have tended to make this an area of slight utilization and meager population. This scarcity of population made impossible an adequate supply of labor so that even if climate and soils were excellent none but extensive methods could be used. Machinery might be made to take the place of labor, but there was and is little capital in Sicily for expensive machinery. Two other factors might help to explain the scarcity of population within this region; the lack of roads and of means of communication and the terrorism and lawlessness caused by the "mafia." According to this code, for it was a code rather than an organized secret society, everyone was a law unto himself and government or legal aid was not resorted to. For decades justice in Sicily had been so confused with political judgments that the people realized that they had to take it upon themselves to provide for security of themselves and of their property. With the resulting breakdown of law and order, this region was terrorized by bands of ruffians and cutthroats. In addition to all these factors, yields were low because many of the "latifondi" owners did not utilize their lands or labor very effectively. Many of the estates were held more for their prestige value than for what they could produce and this, plus the danger of malaria, gave rise to much absentee ownership. In 1926, 47 per cent of the "latifondi" were insufficiently cultivated. In fact some of these were hardly cultivated at all.

As is often the case in such holdings, the peasant class was exploited. Disinterested absentee landlords rented the land to men who in turn subrented it to nearby peasants. Since the profits of those who rented from the "latifondo" owner depended upon what he charged those to whom he subrented the land, the burden on the poor peasants was immense. These peasants lived in tiny, one-room stone huts grouped around the massive stone "masseria" or factory. Hours were long, the work hard, and wages pitifully small—forty to seventy-five cents per day was considered good. Wages were low but not food costs, for macaroni, so important in the native diet, cost from three to six cents per pound prior

to 1920, flour, five dollars per hundred pounds, coffee, sixty cents per pound and beef, fifty cents per pound. Little was done to improve the lands because in most cases the owners cared little and the peasants knew little and had little. No fertilizers were used and often the ground was broken for seed with a pick. However, in many of the very dry areas chemical fertilizers are of little use unless irrigation is available to dissolve the chemicals and carry them into the ground. Otherwise they remain on the surface and spoil the soil. Because of the need for protection the peasants live together in groups and perhaps Sicily has more of her population in towns and communities than any other agricultural country. In fact 90 per cent of Sicily's population lives in towns and cities and must go out to work, sometimes miles away.

Changes have been occurring in the agricultural practices of interior Sicily. Formerly large numbers of cattle were grazed here but as the population of Sicily grew from a little over two million in 1861 to three and one-half million in 1901 and to four million at the present time, more and more of the land was required for production of wheat. Most of the animals of Sicily are in the northern and eastern portions of the country where are located the greatest amounts of pasture (Figure 6). Here are found three-fourths of the equine animals, cattle and goats, and two-thirds of the sheep. Most of the pasture land is in the province of Messina and consequently 18 per cent of all of Sicily's animals are in that province. In 1936 there were but 175,000 cattle in all Sicily. The more hardy sheep and goats totalled over one million. Prior to 1930 the animal industry seemed to be on the decline but since then the number of animals has been increasing. This is probably connected with the desire of Italy to be self-sufficient in foods. The greatest increase, one of 34 per cent, occurred in the number of hogs.

To modify all the conditions which are responsible for the maintenance of the "latifondo" would also modify the production of wheat and other crops. By 1936 the average wheat yield in Sicily had increased 30 per cent over that of 1915—from 12 bushels to 16 bushels per acre. The area devoted to wheat has increased, for the average acreage during the period 1932–36 was 17 per cent greater than that for 1923–28. These spectacular gains are characteristic of all Italy and are chiefly the result of the "Wheat Campaign" started in 1925 in an effort to increase the Italian production of wheat to eight million metric tons yearly which is approximately the amount required for home needs. Although in 1937 the yields were very low, when climatic conditions have been favorable, this figure has almost been reached.

Improved varieties of wheat which mature much more rapidly and thus avoid the decreases in yield caused by the hot winds of the late spring and early summer, have been introduced. Greater amounts of commercial fertilizers are being used and improved methods of soil preparation and crop care have been introduced. All of this demanded an improved educational system which included much agricultural training, and illiteracy has dropped to about 40 per cent. Teaching agents sent out by the government instruct people in the more scientific methods of agriculture. In order to counteract the effects of lack of rainfall on agriculture some 21,000 acres have been irrigated during the period from 1930 to 1937. Improved transportation systems to enable people, materials, and produce to get into and out of the interior have

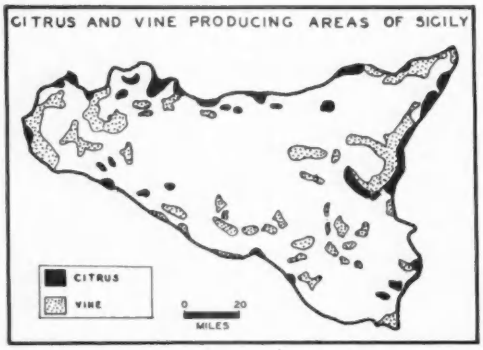


FIGURE 5.—The citrus fruit industry occupies but two per cent of the cultivable and forested area of Sicily, and yet in 1934, 40 per cent of the Sicilian exports were derived from this source. Vine culture is much more widespread but two-thirds of the Sicilian grapes, or six per cent of those of all Italy, are derived from the western and northeastern areas. (Derived from *Enciclopedia Italiana*, Vol. XXXI, p. 662.)

been built and Sicily now has some 5,500 miles of good roads, 1,200 miles of railroads, and a little over 4,000 miles of bus lines. Drinking water supplies have been improved. Mosquito-breeding pools are being done away with and the danger of malaria greatly reduced. Farm machinery is being introduced and Sicily which a few years ago had hardly any tractors now boasts of some 600. Coöperative agencies for the distribution of crops raised by the farmers, and loan funds to enable the farmers to put into practice the recently learned methods which require machinery and fertilizers, have been set up.

It can readily be seen that all of these factors, besides increasing the amounts of food available by making for a more intensive and productive agriculture, are also attacking the very bases of the "latifondo." There is a break up of the "latifondo" taking place, for in the period from 1907 to 1926 the number of "latifondi" decreased from 1,400 to 1,050. Just what percentage of land for use in small-sized parcels has been released by this reduction is not known for Sicily as a whole, but in the case of the province of Palermo the reduction in the number of "latifondi" from 263 to 206 by 1925 lowered the percentage of the total productive area held by the "latifondo" from 41 per cent to 35 per cent. Several other factors also enter into this break up of the "latifondo." Emigration from Sicily has always been great because of limited opportunities. From 1901 to 1936 some 920,000 people left Sicily. The resulting scarcity of labor in some parts forced many of the "latifondi" owners to introduce machinery and improved methods. Many of the emigrants sent back money which they had saved and thus many tracts of land were purchased, particularly at the close of the World War when many of the "latifondi" owners feared government confiscation of their lands. This question of government confiscation is now very serious, for the present plan will attempt to correct the mal-distribution of Sicilian agricultural lands by placing families on the smaller farms into which the large holdings are to be divided. This plan calls for the expenditure of more than 100 million dollars over a ten-year period and has in it a confiscation clause. The fundamental ideas of this "Bonifica Integrale" program were first brought out in December, 1928. This "integral land reclamation" program aims to make possible a more intensive use of the land and a higher standard of living by improving the land and its methods of utilization. There are to be 20,000 farmhouses built on 1,250,000 acres of land; 2,000 complete farms are to be built immediately to be ready for use by November, 1940. But before these can be built, preliminary land reclamation work such as the building of aqueducts, reservoirs and artesian wells, the construction of connecting roads, of schools and churches must be done. Of the total appropriation 44

per cent is to be absorbed by these public works. The rest will go to the land owners in the form of grants to carry out the necessary land and agricultural improvements. Should the owners refuse to coöperate their land will be expropriated at its current taxable value. The lands which are to be improved represent almost 20 per cent of the area of Sicily but according to the last figures available, those of July, 1935, only 4.4 per cent of the total to be improved had actually been completed.

Sicily is an agricultural nation partly because of certain climatic and soil conditions and also because it has but few ways of employing its people other than by agriculture. Unfortunately these few are located in the coastal regions rather than in the interior where there is a need for supplementary employment.

There is an important sulphur mining industry centered at Agrigento in the south-central part of the island. Until the advent of the cheap sulphur of Texas and Louisiana, Sicily was the chief source of the world's sulphur and the industry supplied work for 25,000 men. Now, however, it employs a much smaller number, probably not more than 9,000 men in 1927. There is also some mining of asphalt and chalk and the production of some salt. Fishing, off the eastern and western coasts in particular, employs some 22,000 men but none of the fishermen are farmers and fishing appears to be a steady occupation. The tourist trade is an important source of income for Sicily and until recently it has had a yearly influx of 60,000 people who left some three million dollars within the country. The tourists are attracted by the natural scenic beauty of the coasts, by towering Mount Etna, and by the numerous ruins built by Greeks,

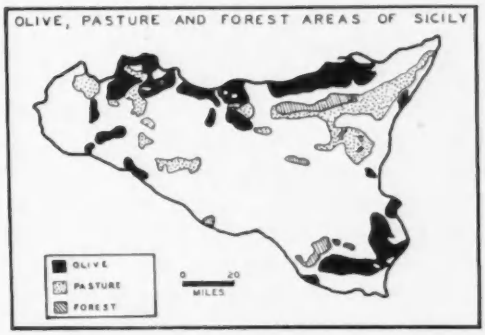


FIGURE 6.—Olive culture occupies about 14 per cent of the cultivable and forested area. Although there are four major zones of production, that included in the provinces of Agrigento and Trapani in western Sicily produces about one-third of the total harvest. Pasture lands are concentrated in the northwestern corner with the result that the province of Messina alone has 18 per cent of all the animals in Sicily. (Derived from *Enciclopedia Italiana*, Vol. XXXI, p. 662.)

Saracens, and Normans. The interior has not benefited by this trade since poor transportation has made it so inaccessible and nature has made it so unattractive.

So it is that Sicily is agricultural partially because it has some definite advantages for agriculture and partially because there is little else that can be done. Perhaps such crops as the lemon, provided the disease "mal secco" can be controlled, the orange, olive, and vine, for which it has excellent natural conditions, will continue to make its presence felt in world markets in spite of strong competition from areas of similar climate which has curtailed rather drastically the export of both citrus fruits and citrus fruit derivatives. (So great has been the destruction of Sicilian lemon trees by the disease "mal secco" that it has been estimated that the acreage of commercial groves has declined from the 58,200 acres of 1929 to the 44,000 acres of the present time. "Italian Agriculture Under Fascism and War," N. William Hazen. *Foreign Agriculture*, Vol. IV, No. 11, Nov. 1940, p. 654.)

The possibility of Sicily's producing enough of the major foodstuffs to feed any other area but itself appears to be rather remote for, in spite of tremendous increases both in yields per acre and in the area devoted to the production of wheat, the proportion of Italy's wheat supply provided by Sicily increased only from 11.1 per cent to 11.7 per cent when the average annual yields for the two periods, 1923–28 and 1932–36 are compared. It must also be remembered that the spectacular nature of the increases is partially due to the fact that initial yields were exceedingly low. Sicily must still import more wheat than it exports. Wheat imports from foreign countries have declined until in 1934 they were but one-fifth of what they were in 1929 but during the same period wheat imports from Italy increased seven times.

Sicily has greater possibilities of increasing wheat yields than has the rest of Italy because the improved varieties accounted for 62 per cent of the total Italian wheat yield but in Sicily these provided only 24 per cent of the total yield. A much smaller percentage of the land to be developed in Sicily has actually been improved so that there is a possibility of greatly increasing total yields as more and more land is made available to agriculture. However, all of these improvement schemes are very expensive and increased production will undoubtedly be high-cost production.

Not only is Sicily no supplier of food, but it is no place to which Italians from the mainland can go. Sicily has the unenviable record, as has been stated above, of exceeding all other areas of Italy as a source of emigrants. Below is a table showing the excess of emigrants over immigrants from 1901 to 1936.

EXCESS OF EMIGRANTS OVER IMMIGRANTS

Period	*Yearly Average*
1901–1911	21,570
1911–1921	29,355
1921–1931	21,320
1931–1936*	39,320

*Five year period.
Source—"Banco di Sicilia," 1937: p. 30.

Sicily will probably continue to increase its production of all sorts of foodstuffs but these increases will most likely have to be used at home for the local population. Perhaps the large-scale improvements now being attempted will be able to increase Sicilian production enough to permit sizable contributions of food to the rest of the country but it will be a long time before these projects are fully completed and their effects on production felt.

SHOPPING AREAS OF THE NEAR SOUTHWEST

William T. Chambers

STANDARD dictionaries inform us that a shopper is one who visits shops for the purpose of buying or inspecting goods. Therefore it seems proper to designate that area about a city from which many people come to inspect and purchase merchandise displayed in its shops and stores as the shopping area of that particular city. In preparing this map showing the shopping areas of the Near Southwest (business people often refer to Texas, Oklahoma, Arkansas, and Louisiana as the Southwest but the term Near Southwest seems to be more appropriate) it has been my purpose to include in the area of each city only that territory in which its commercial institutions

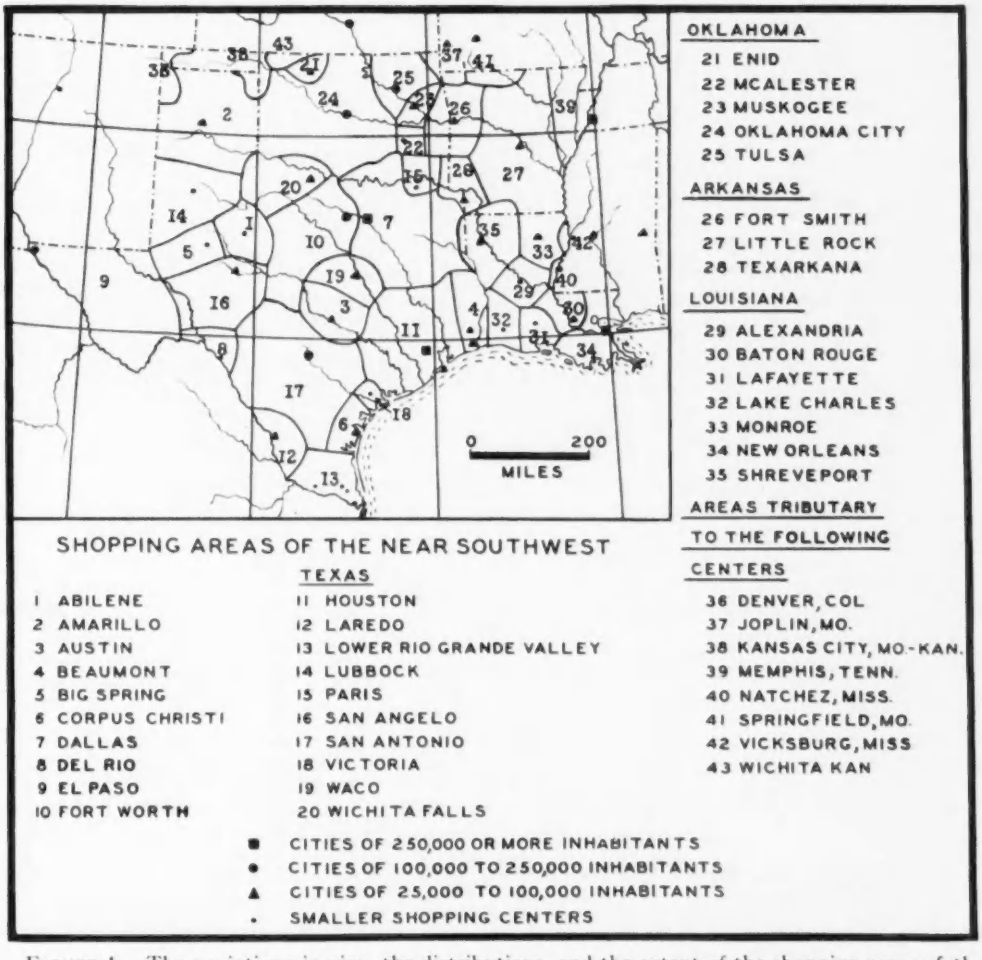


FIGURE 1.—The variations in size, the distributions, and the extent of the shopping areas of the Near Southwest cannot readily be comprehended without reference to the map. The character of the shopping area is in some measure determined by the character of the surrounding countryside, and partly by the composition of the population.

dominate the so-called shopping activities of the people. And these activities are conceived as including particularly retail trade in those classes of merchandise which people seek in distant markets, if necessary, in order to secure satisfactory goods.

This study is based primarily upon information received from chambers of commerce and similar organizations in various parts of the area covered. It is probably true that if anyone is prepared to say where most of the out-of-town shopping of a given locality is done it would be the officials of a chamber of commerce located there. For example, if the secretary of the Nacogdoches Chamber of Commerce believes that Dallas receives most of the shopping business attracted from the Nacogdoches area, while the Lufkin Chamber is equally confident that Houston is the principal out-of-town shopping center for the people of that area, I see no adequate reason for disparaging these opinions. Moreover the relative commercial power of Dallas and Houston as well as the length and character of their highway outlets to Nacogdoches and Lufkin, respectively, indicate that these opinions are probably correct. Hence the line separating the Dallas and Houston shopping areas is drawn between Nacogdoches and Lufkin.

In allocating areas I preferred to rely upon direct reports from the various places concerned, but where reports were not forthcoming, boundaries were placed in what seemed to be the most reasonable position after carefully weighing the relative distance and the character of highway routes to various shopping centers, the relative commercial power of these centers, and any other available data. For example, no reply came from Hillsboro, county seat and principal city of Hill County, located in central Texas. The nearest shopping center is Waco, 33 miles to the south, but Hillsboro is only 58 and 63 miles respectively from Fort Worth and Dallas on the north. This 25- to 30-mile differential in favor of Waco can hardly be expected to pull the bulk of Hillsboro shopping trade (including mail order business) to that city in the face of Dallas and Fort Worth competition since discriminating shoppers are willing to go farther

FIGURE 2.—A ground view of the Dallas skyline as seen from the valley of Trinity River. (Lloyd M. Long. Courtesy of Dallas Chamber of Commerce.)

in order to reach a greater market where larger stocks of merchandise are displayed. Moreover Hillsboro mail order trade centers at Dallas and Fort Worth because these cities have great branch houses of Sears Roebuck and Co., and Montgomery Ward and Co., respectively. Now it is only five miles farther to Dallas than to Fort Worth from Hillsboro, and since Dallas is unquestionably the greater commercial center, it seems certain that Hillsboro should be included in the Dallas Shopping Area. This disposition of the matter is further supported by the fact that both Denton and Gainesville, although somewhat nearer Fort Worth, report that Dallas is their chief shopping center.

FIGURE 3.—Texas Hall of State, central building in the exposition plant at Dallas where the State Fair of Texas is held. (Parker-Griffith. Courtesy of Dallas Chamber of Commerce.)

In preparing the map (Figure 1) I arbitrarily denied recognition as shopping centers to cities which fail to dominate the trade of appreciable areas outside the home county. Since so many counties have an outstanding center of local retail trade, this restriction seems necessary to preserve the simplicity and general purpose of the map. However, it results in exaggeration of the importance of small centers located in sparsely settled areas as compared with larger centers of local retail trade that are overshadowed commercially by neighboring cities of major regional importance.

Perhaps the most significant fact revealed by this survey is the dominant position of Dallas in the commercial activities of Texas and the Near Southwest. Such distant and widely separated cities as Amarillo, Atoka (Okla.), Atlanta, Woodville, New Iberia (La.), Johnson City, and Fort Stockton rank the North Texas metropolis ahead of all other outside centers in the volume of shopping trade (including mail order business) obtained in their respective localities. The Abilene Chamber of Commerce wrote, "As to the city which attracts most shopping trade from Abilene, Dallas is far in the lead, regardless of the fact that Fort Worth is nearer." There can be no question that Dallas is the outstanding shopping center of Texas and of the Near Southwest.

Why is Dallas the great commercial emporium of Texas and the Near Southwest? My map shows that the

shopping area she dominates is roughly comparable in size with those held by Houston, San Antonio, Fort Worth, Oklahoma City, and Little Rock. But people familiar with the geography of the Near Southwest know that the Dallas area contains a more dense population than is found elsewhere, as well as more sizable cities and towns from which many discriminating shoppers may be drawn. Located in the broad northern part of the fertile Blackland Prairie, at a major highway, railroad, and air route focus, in the very heart of the vast petroleum and cotton producing portions of the Near Southwest, Dallas commands the greatest market for consumers' goods to be found in all this section. With such a rich trading territory at her command, it is to be expected that greater stores with larger stocks of merchandise will develop there than at other centers in this section. To use the apt words of Joe Mock, Secretary of the Nacogdoches Chamber of Commerce, "Neither Houston, San Antonio, nor Fort Worth has a group of great retail houses comparable with Neiman Marcus, A. Harris, Sanger Brothers, and Titche Goettinger." Now this statement loses none of its veracity if New Orleans, Oklahoma City, and Little Rock are included. And Dallas, equipped with these and other great commercial institutions, attracts much shopping business from her chief competitors in this field. Moreover many shoppers drive through these great centers to select goods from the larger stocks of the great Dallas stores.

Houston is the great port and largest city of Texas, but her shopping business is definitely smaller than that of Dallas.

FIGURE 4.—The turning basin and end of the 45-mile long Houston Ship Channel, leading port on the Texas coast. (Courtesy of Houston Chamber of Commerce.)

FIGURE 5.—St. Mary's Street in the central business section of San Antonio. (H. L. Summerville. Courtesy of San Antonio Chamber of Commerce.)

Her total retail sales almost equal those of Dallas. But this is due to the fact that the resident population is larger, so that local sales of groceries, notions, drugs, and other ordinary consumers' goods are greater than at the North Texas city. However, the advantage conveyed by this large resident population is offset by the fact that her shopping area has relatively fewer people per square mile, with a lower average standard of living. Moreover Houston shops and stores find it impossible to attract customers from the Gulf of Mexico in anything like the volume that West Texas patronage comes to Dallas.

San Antonio is the great commercial center of a section known as Southwestern Texas. This city has a larger shopping area than either Houston or Dallas, and its retail houses attract many customers from the trade territories of smaller centers in that section—Austin, Corpus Christi, Victoria, Laredo, and Del Rio. Yet the volume of this shopping trade is restricted by the relatively low density of population in all that section, particularly in the extensive ranching areas to the south, west, and northwest of the city As a major American center of military training activities, San Antonio retail trade is augmented by a large and growing Federal payroll.

Fort Worth ranks fourth among the shopping centers of Texas, and the only other cities of the Near Southwest which surpass her in this respect are New Orleans and Oklahoma City. Her trade territory extends westward and southwestward from the city, through the north central part of Texas where ranches, farms, and oil and gas fields are numerous. Being the largest city and principal market of West Texas, Fort Worth secures much patronage from that section. Montgomery Ward and Co. serves Texas and parts of adjoining states from a regional mail order house located there.

El Paso is the principal urban center

FIGURE 6.—Robinson Avenue in the central business section of Oklahoma City. (Courtesy of Oklahoma City Chamber of Commerce.)

of a vast territory located in western Texas, southern New Mexico, and the Mexican state of Chihuahua. The desert basins and stony mountains of that section have low potential as consuming areas, but the inhabitants of its ranches, irrigated districts, and mining towns willingly ride long distances to reach the relatively large market at El Paso.

Amarillo, Lubbock, and Big Spring, on the High Plains, and Wichita Falls, Abilene, and San Angelo, located below the Cap Rock, are other West Texas shopping centers. Amarillo is the hub of the Texas Panhandle, while the shopping business of the South Plains and a strip of land bordering them on the east is divided between Lubbock and Big Spring. The Wichita Falls Shopping Area includes some land in southern Oklahoma, and extends westward across the fertile redland belt of that section. Abilene is located near the center of her trade territory, but that of San Angelo extends westward beyond Pecos River. This vast section has a rather dry climate, and is less densely populated than the lands farther eastward. But all of these cities are thriving business centers, because their trade territories are devoted to commercial agriculture and livestock raising, as well as to producing oil and natural gas.

Austin, Waco, and Beaumont are other important Texas shopping centers. The trade territories of Austin and Waco form a circular zone wedged between the areas dominated by Dallas, Houston, San Antonio, and Fort Worth. The Waco area is naturally more fertile and supports a larger population; but Austin, the state capital and seat of the University of Texas, is the better shopping center because people from

FIGURE 7.—Aerial view of Little Rock looking across the Arkansas River to the city of North Little Rock. (Fausett-Hogue Photo Co. Courtesy of Little Rock Chamber of Commerce.)

every part of Texas spend money there. The Beaumont territory, located in southeastern Texas and the adjacent part of Louisiana, although rather sparsely settled, is a prosperous commercial area because it produces petroleum, rice, and lumber.

No one center dominates shopping trade in the Lower Rio Grande Valley. Brownsville, the largest city, makes no claim to dominance outside Cameron County, and even there its leadership is challenged by Harlingen, which, although smaller than Brownsville, has a more central location in the county and section. Farther westward is McAllen, a center which asserts its leadership in the Valley. But McAllen is smaller than either Brownsville or Harlingen, and its location in the relatively narrow western part of the irrigated and densely populated Valley area is sure to handicap its shopping trade. San Benito is another important center of retail trade in this section. Thus three or even four cities seem to share the shopping trade of the Valley more or less equally, a situation quite unlike that in other parts of the Near Southwest.

Two important Texas cities, Galveston and Port Arthur, fail to classify as shopping centers. Their marine locations, together with the presence of Houston and Beaumont respectively, between them and the Texas interior, tend to prevent the acquisition of shopping trade from areas outside their immediate environs. Galveston is the chief business center of Galveston County, and Port Arthur dominates retail trade in the southern part of Jefferson County. But Galveston is primarily engaged in ocean trade, shipping vast quantities of cotton, wheat, grain sorghum, wool, mohair, sulphur, and copper; while the prosperity of Port Arthur is geared to her huge petroleum refineries and the shipment of their products to the markets of the world.

FIGURE 8.—View of the central business section of New Orleans and Canal Street, one of the widest and best lighted thoroughfares in the United States. (Courtesy of New Orleans Association of Commerce.)

The principal shopping area of Oklahoma is that of Oklahoma City. Located at a major highway and railroad focus near the center of Oklahoma, the city dominates shopping activities throughout the central and west central portions of that state. Its tributary area includes thriving secondary centers such as Ponca City, Shawnee, Seminole, Wewoka, Chickasha, and Ardmore. There are large areas of good farming land where cotton, wheat, corn, and the grain sorghums are grown, and where many cattle and hogs are raised. With much petroleum production within the city, with several oil and gas fields in its trade territory, and with the advantages of being the state capital and of having the state university within short motoring distance (20 miles), one wonders that Oklahoma City is not a greater shopping center than it is.

Tulsa is the other outstanding shopping center of Oklahoma. Its tributary area is much smaller than that of Oklahoma City, but Tulsa is in a good wheat and livestock producing section, and it dominates one of the world's greatest oil and gas field areas. The rapid growth of the city and its large

shopping business are, in large measure, responses to the vast development of the oil industry there.

Enid and Muskogee are other important Oklahoma shopping centers. They are railroad and highway foci, located respectively in the north-central and the east-central portions of the state. Muskogee has the more populous shopping area, but its northern portion is in the rugged Ozark country. Like Oklahoma City and Tulsa, these shopping centers are beneficiaries of the great oil industry of the state.

FIGURE 9.—The great toll-free Huey P. Long Bridge across the Mississippi River at New Orleans. Completed in 1935, this combination railroad, highway, and footpath bridge facilitates the attraction of shoppers from the section west and southwest of the city. (Courtesy of New Orleans Association of Commerce.)

The far western extremity of Oklahoma and some adjacent land in the northwestern corner of Texas is tributary to Denver, Colorado. The remainder of the Oklahoma Panhandle, together with the northeastern corner of the Texas Panhandle, is in the Kansas City Shopping Area, while some adjoining land to the east is tributary to Wichita, Kansas. Joplin, Missouri, attracts shopping business from a small area in the northeastern corner of Oklahoma and the adjacent part of Arkansas.

McAlester has a relatively small and poor shopping area in the southeastern interior of Oklahoma. It extends mainly southeastward from the city, into the rugged Ouachita Mountain section of the state. Paved Federal highways and a bridge across Red River combine with the Ouachita Mountain barrier to make the section about Idabel, Antlers, and Hugo in southeastern Oklahoma tributary to Paris, Texas.

Little Rock, in central Arkansas, is the principal shopping center of that state. Located near the eastern base of the Ouachita Mountains, at a major crossing place on the Arkansas River, Little Rock is the capital city and chief focus of transportation routes in that state. Its trade territory includes all of central Arkansas, and extends from the Louisiana and Mississippi boundaries on the south and east to Missouri on the north. However, the development of this vast area is so retarded, chiefly due to poor natural drainage in the south and east, and to the rugged stony character of the Ouachita-Ozark sections to the west and northwest, that the city is smaller and has less shopping business than Tulsa.

Fort Smith is the secondary shopping center of Arkansas. Located on the Arkansas River beside the western boundary of the state, Fort Smith is the chief center of an extensive section in central-western Arkansas and an adjacent portion of Oklahoma. But this territory includes so much Ozark and Ouachita mountain land that its market capacity is smaller than its size suggests, with the result that Fort Smith is a rather small shopping center.

With characteristic American optimism, Texarkana business houses boast that they serve three states. The city is located athwart the Texas-Arkansas boundary, rather near the southeastern corner of Oklahoma. State Line Aven-

ue, one of its business streets, follows the state boundary, and half of the Federal Building and the railroad station is in each state. The Texarkana Shopping Area includes territory within the boundaries of Arkansas, Texas, and Oklahoma.

Five Federal highways, a free bridge across Mississippi River, and several trunk railroad lines, make Memphis, Tennessee, accessible to the inhabitants of northeastern Arkansas. With larger shops and stores than Little Rock and a branch mail order house of Sears Roebuck and Co., Memphis succeeds in dominating the shopping trade of all this section. A much smaller strip of land in the Ozark section of northern Arkansas is in the shopping area of Springfield, Missouri.

New Orleans is the principal shopping center of Louisiana. Its retail sales, far greater in value than those of any other Louisiana city, are comparable to those of Dallas or Houston. But this great volume is mainly due to the large resident population of the city and the resulting heavy sales of groceries, notions, drugs, beverages, tobacco, and other "pick-up" lines of merchandise. Cities farther inland intercept the trade of their respective sections, restricting the New Orleans Shopping Area to the delta parishes of Louisiana and the southern portion of Mississippi. And since much of this relatively small section is sparsely populated marshy lowland or cut-over forest country, its market capacity is narrowly limited. Hence New Orleans, like Galveston or Port Arthur, is a less important shopping center than the large population and great regional importance of the city suggest.

Shreveport, located in the northwestern corner of Louisiana, is the second shopping center of that state. Its commercial activities are handicapped by state boundaries which tend to retard the attraction of trade from the west and north. Yet Shreveport is the largest city of an extensive section, and its shops and stores do secure much patronage from nearby parts of Texas and Arkansas. Its tributary area is notably better than that of New Orleans since it has rich oil and gas fields as well as good farming lands.

Baton Rouge is the third shopping center of Louisiana. Although the tributary area is rather small, it shares with New Orleans the rich sugar cane producing section in the Mississippi River delta, and secures some trade from all parts of Louisiana because the state capital and university are located there.

Monroe, Lake Charles, and Alexandria are other fairly important shopping centers of Louisiana. Monroe dominates trade in the northeastern portion of the state where cotton growing and lumbering are principal industries. Alexandria is an important focus of Federal and state highways. It secures much trade from the central part of Louisiana. Lake Charles, a port city, located in the rice-growing, saw-milling, and oil-producing southwestern portion of the state, has a shopping area in that section. Lafayette is the shopping center of a rice and sugar cane growing area in central southern Louisiana, and two small Louisiana districts, located beside the Mississippi River are tributary to Natchez and Vicksburg, respectively, commercial centers in the state of Mississippi.

LOCATION FACTORS IN THE COMMERCIAL COCONUT INDUSTRY

George F. Deasy

WELL over nine-tenths of all the copra and coconut oil that enters world commerce from primary producing areas comes from five centers: the Philippine Islands, the Netherlands East Indies, the South Sea Islands, British Malaya, and Ceylon (Figure 1). No other part of the Tropics offers serious competition to these five regions in commercial coconut production (Table I). (It is estimated that some forty per cent of the annual coconut harvest of the world is consumed in the countries of origin. The remaining sixty per cent enters international trade.)

The factors determining this concentration of the commercial coconut industry within a restricted segment of the Tropics have never been systematically and comprehensively stated in geographical literature. Complete lack of explanation of the situation, or overemphasis of one or two factors, has been the common method of treatment. In a few instances, the factors involved in the localization of the coconut industry within a particular island or group of islands have been adequately discussed, but the application of these and other factors to the world situation has apparently thus far not been undertaken.

The purpose of this paper, therefore, is to indicate and briefly evaluate, in so far as data are available, those environmental, economic, political, and ethnic factors that have operated and are operating in unison to make certain portions of the Asiatic and Pacific Tropics the outstanding commercial sources of one of the world's major vegetable-oil raw materials.

Temperature Factor

The coconut palm is a true tropical tree; it cannot withstand cool or cold weather. A mean annual temperature of about 68 degrees F. is necessary, and the optimum yearly temperature for best growth and maximum yields is 80 degrees F. or higher. The diurnal temperature range should be small, preferably not exceeding 10 degrees F. The minimum temperature that the tree can withstand is approximately 45 to 50 degrees F. In a word, the coconut palm is limited to regions that are "always hot."

Despite these limitations, however, a glance at the map in Figure 2A will show that there is a vast area in the Tropics which meets the temperature requirements of the tree. This includes most of the land between the Tropics of Cancer and Capricorn, exclusive of the highland regions. The temperature factor, therefore, merely sets the outer limits, beyond which the culture of the coconut palm is usually impossible. Other factors must operate to bring about the greater localization of the commercial coconut industry.

It should be noted in connection with the temperature factor, however, that the poleward borders of the "Always Hot Zone," with their lower mean annual temperatures, their greater daily temperature variations, and the possibility of "cool spells" during periods of invasion by temperate-zone air masses, are not so favorable to widespread and

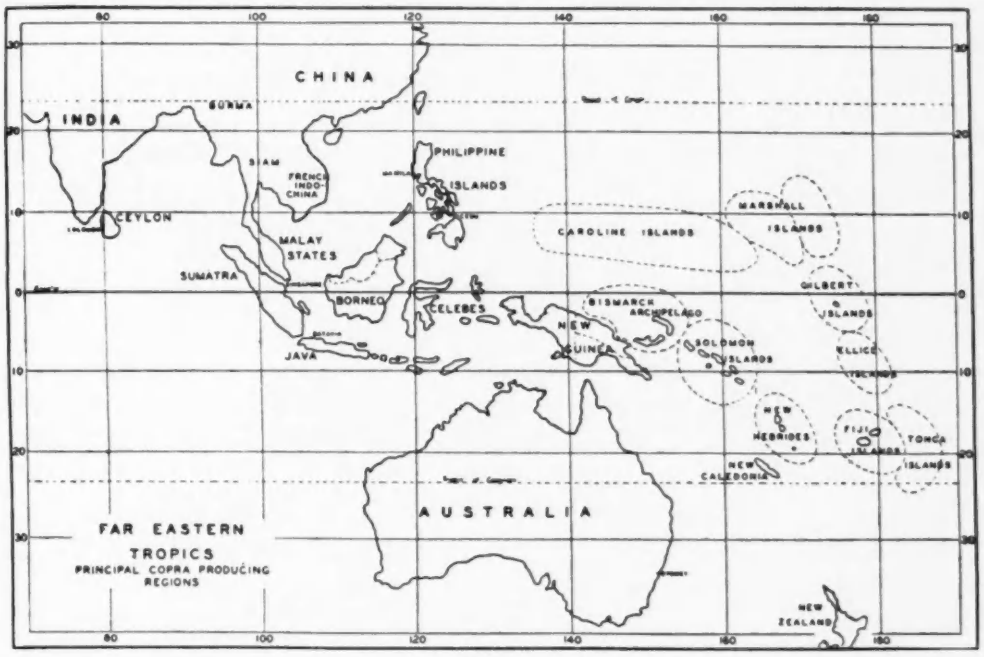


FIGURE 1.—Principal copra-producing regions of the world. (Source "Copra and Coconut Oil" by Snodgrass, p. 36.)

successful coconut production as are those parts of the zone lying closer to the Equator. Hence, other things being equal, such regions as the northern West Indies, northern Peninsular India and Indo-China, southern Brazil, southeastern Africa, and northern Australia are not likely to be major coconut-producing centers.

PRECIPITATION FACTOR

In addition to constantly high temperatures, the coconut palm requires heavy rainfall. The tree can survive and produce a little fruit with an annual precipitation of as little as 40 inches, but for profitable growth and yields a yearly rainfall of at least 60 inches is required. Optimum conditions would necessitate a rainfall of 80 inches or more. Precipitation apparently cannot be too great, for there are records of thriving groves in regions receiving as high as 190 inches a year.

The rainfall likewise must be well distributed throughout the year. The tree stores little moisture and it lacks a tap root; hence it is not suited to regions with a long and pronounced dry season, in which the water-table drops some distance below the surface level. However, if the yearly rainfall is very high, and if surface conditions are such that the ground-water level remains high, the tree is able to survive and produce abundantly in areas with several months of dry weather.

The application of the above precipitation restrictions to those regions with suitable temperature characteristics results in a considerable reduction in the potential commercial coconut-producing areas. Figure 2B indicates those portions of the "Always Hot Zone" receiving an average annual precipitation of 60 inches or more. In most cases this rainfall is well distributed throughout the year. In a few instances, however,

there is a distinct dry season (the Indian and Indo-Chinese areas, for example), but the total fall of rain is sufficiently great to maintain soil moisture at appropriate levels throughout the year. All remaining parts of the "Always Hot Zone" either receive too little rainfall, or that which occurs is too distinctly seasonal in character. The precipitation factor, therefore, removes from consideration as possible major coconut-producing centers: (1) much of the Mexican, Central American, and northern West Indian regions; (2) a considerable proportion of the South American area; (3) most of the African section; (4) all of the Arabian section; (5) much of the Indian and Indo-Chinese regions, and (6) all of the Australian section. The only segments of the "Always Hot Belt" that remain essentially unchanged are the East Indian and Pacific areas. (Decided differences in rainfall exist between the wet windward and dry leeward sides of many of these islands, but they cannot be indicated on the small-scale map used.)

SOIL, GROUND-WATER, PLANT PROPAGATION, AND TRANSPORTATION FACTORS

Even though the climatic factors are favorable for the coconut palm, certain ground-water and soil conditions must exist for the tree to thrive. Generally speaking, for best results the following are necessary: (1) a loose, porous soil and sub-soil, preferably sand or alluvium (heavy clay soils are detrimental to growth and yields); (2) a continuously high water-table, and (3) rapid and continuous movement of ground-water (stagnant ground-water is very injurious to the palm).

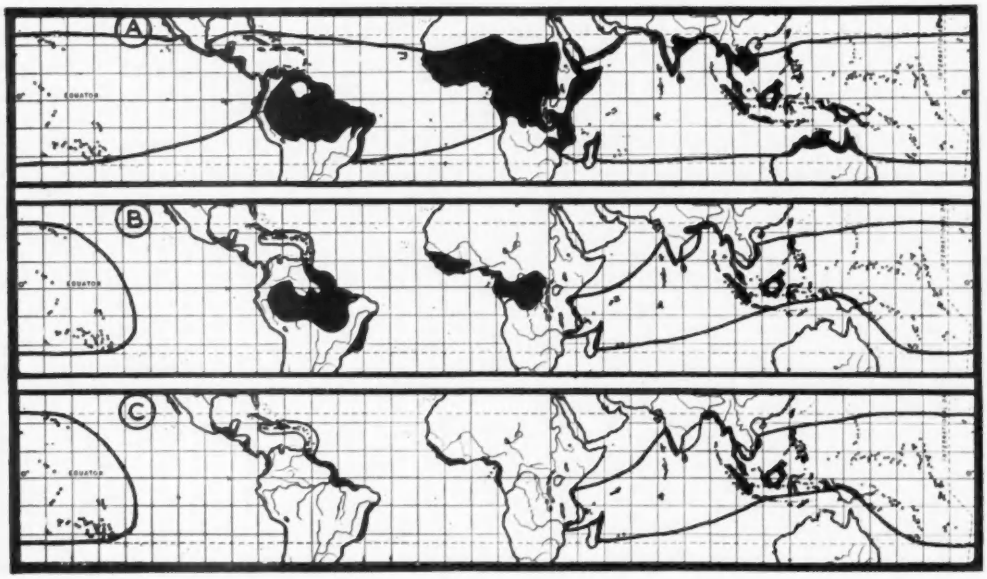


FIGURE 2.—Restriction of potential commercial coconut areas by natural and human factors.

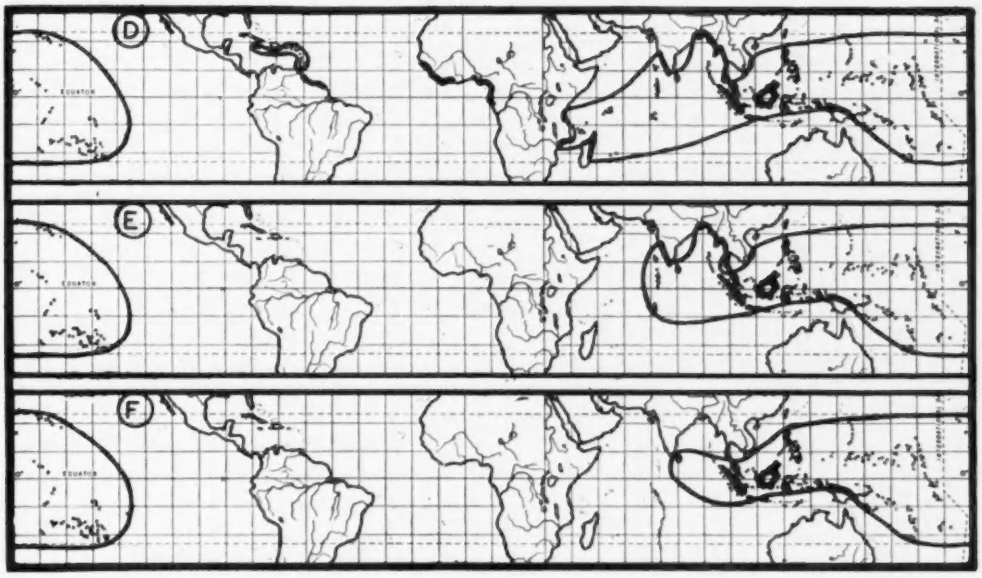
A. Areas with favorable temperature conditions for commercial coconut production. (The small highland "cores" of many of the islands cannot be indicated on a map of this scale.)

B. Areas with favorable temperature and precipitation conditions for commercial coconut production. (The decided differences in rainfall between leeward and windward sides of many of the islands cannot be indicated on a map of this scale.)

C. Areas with favorable temperature, precipitation, soil (in part), ground-water (in part), and transportation facilities for commercial coconut production.

Such a combination of soil and ground-water conditions can exist in a number of different sites. Perhaps the most common place where they are simultaneously encountered, however, is along seashores backed by highlands. Porous sandy beaches experience rapid and constant movement of ground-water caused by the ebb and flow of the tide, and are the last to react to a period of drought by a lowering of the water-table. Hence, while the coconut palm will grow and is actually found in many inland sites within the wet tropics where suitable soil and drainage conditions exist, the seacoasts seem to offer the largest expanses of favorable territory and the coconut industry tends to be concentrated there. In India, for example, coconut groves are located over three hundred miles from the sea, and at altitudes ranging up to several thousand feet.

Furthermore, many of the present producing palms were not planted by man but are instead natural growths. Such trees are invariably found along coasts, since the coconut fruit is lighter than water and is frequently washed to adjacent shores where it takes root and grows. No other simple method of seed dispersal exists to produce extensive inland natural growths. Hence, this factor also tends to localize the coconut industry along coasts.



D. Areas with favorable temperature, precipitation, soil (in part), ground-water (in part), transportation, and political conditions for commercial coconut production.

E. Areas with favorable temperature, precipitation, soil (in part), ground-water (in part), transportation, political, labor, competitive crop, and ethnic conditions for commercial coconut production.

F. Areas with favorable temperature, precipitation, soil (in part), ground-water (in part), transportation, political, labor, competitive crop, ethnic, and domestic market conditions for commercial coconut production. These areas are the actual exporters of large quantities of copra and coconut oil.

Finally, copra is a bulky, cheap commodity. It is not well adapted to long and costly overland shipments in tropical regions, where transportation costs are excessively high. Therefore another factor—that of location or accessibility—tends to localize the commercial coconut industry of the world along coasts.

The map in Figure 2C shows the net results of the operation of all the above

factors. The major potential commercial coconut-producing areas are seen to be confined to the coastal portions of those parts of the Tropics possessing suitable temperature and rainfall characteristics. All parts of these coastal districts shown on the map do not have suitable soil and drainage features, but local data are lacking in most cases to differentiate the areas on this basis. The main argument, however, that it is coastal rather than inland districts that are most suitable for commercial coconut production, still stands. In this way all of interior South America and Africa can be eliminated from consideration.

POLITICAL FACTOR

In so far as natural environmental conditions are concerned—i.e., temperature, precipitation, soil, drainage, and accessibility—all the coastal areas previously indicated in Figure 2C are apparently equally well adapted to the commercial production of coconuts. The introduction of the political factor, however, changes this picture.

Certain of these tropical coastal areas are colonial possessions of some of the major copra and coconut oil importing countries of the world. The remainder lack political affiliations. It is only natural that the mother countries should favor the coconut products of their dependencies, either by direct tariff regulations and processing taxes or by the more intangible and elusive but equally effective business, commercial, and shipping ties that exist between the various parts of an empire. It is not coincidence that enables the Philippine Islands to furnish the United States with most of its copra and coconut oil, or Malaya, Ceylon, and the British South Sea Islands to supply the British Empire with its imports of similar products, or the Dutch East Indies to find their major market in the Netherlands (Tables II, III, and IV). Colonial possessions, therefore, possess a very real and tangible asset over their potential non-colonial competitors.

The colonial areas benefit in still another way from their status as wards of the Great Powers. Their internal financial and political life is generally stable. Hence, when large purchasers of coconut products who have no tropical colonies, such as Germany and Denmark, look about to establish suitable commercial contacts, they usually favor the stable colonial countries to the exclusion of the unstable non-colonial areas. Likewise, when investments are being made in modern coconut plantations, it is generally the colonial areas that are chosen for development.

Figure 2D shows the results of the political factor as it modifies the potential commercial coconut-producing areas. All of Central and South America except British Honduras and the Guianas, as well as some of the West Indies islands, lack the necessary political ties. It is chiefly the Asiatic, Pacific, and African coastal areas that possess assured middle-latitude markets (Siam is an exception).

LABOR SUPPLY, COMPETITIVE CROP, AND ETHNIC FACTORS

For a region to become a truly large producer of coconut products it must possess not only the basic environmental complex to permit production and the necessary political connections to stimulate production, but it must also have a sufficiently large and dense population adequately to utilize the favorable existing opportunities.

Table V shows the total population and the population density per square mile of each of the remaining potential commercial coconut-producing countries, excluding Oceania. Population figures

TABLE I

MAJOR COPRA AND COCONUT OIL EXPORTING REGIONS, 1936*

Asia	1,339,800
Philippine Islands	542,800 (first)
Netherlands Indies	509,600 (second)
British Malaya	152,900 (fourth)
Ceylon	108,000 (fifth)
British Borneo	11,400
French Indo-China	10,700
Siam	3,700
Timor	600 (1935)
Portuguese India	100
India	.....
Oceania	217,300 (third)
New Guinea	67,800
Fiji Islands	35,100
Solomon Islands	25,500
French Settlements in Oceania	22,100
Western Samoa	13,200
Japanese Mandated Islands	12,200
Tonga	12,100
Papua	10,700
New Hebrides	10,600
Gilbert and Ellice Islands	5,200
New Caledonia	2,800
Africa	74,000
Mozambique	34,200
Zanzibar	13,300
Tanganyika	7,600
Togoland	7,400
Seycheles	5,100
Gold Coast	2,600
Madagascar	1,600
Mauritius	1,200
Nigeria	200
Others	800
Central America	5,400
Trinidad and Tobago	4,300
West Indies	1,000
British Honduras	100
South America	700
British Guiana	700
World total	1,637,200

*Metric tons; coconut oil in terms of copra.
Source: International Institute of Agriculture, 1939.

TABLE II

PERCENTAGE OF UNITED STATES IMPORTS OF COPRA AND COCONUT OIL COMING FROM THE PHILIPPINE ISLANDS*

Year	*Per cent*
1929	79
1930	76
1931	80
1932	70
1933	81
1934	93
1935	99
1936	99
1937	94
1938	98
1939 (Jan.-June)	100

*Coconut oil in terms of copra.
Source: U. S. Dept. Agr.

TABLE III

PERCENTAGE OF COPRA AND COCONUT OIL EXPORTS OF THE PHILIPPINE ISLANDS GOING TO THE UNITED STATES*

Year	*Per cent*
1929–33	85
1934	65
1935	90
1936	78
1937	93
1938	79

*Coconut oil in terms of copra.
Source: U. S. Dept. Agr.

TABLE IV

PERCENTAGE OF UNITED KINGDOM IMPORTS OF COPRA COMING FROM BRITISH EMPIRE PRODUCERS

Year	*Per cent*
1927	74
1928	76
1929	71
1930	68
1931	62
1932	91
1933	100
1934	98
1935	100

Source: Intern'l Institute of Agriculture.

for the actual potential producing areas within each country are not available, but labor within the confines of individual political units is usually rather highly mobile, if conditions warrant the movement. The total population of all African colonies having suitable coastal areas is about 71 million, but the average population per square mile of these countries is less than 14. The Asiatic countries have a total population, excluding India, of over 110 million and an average population density of about 92 per square mile. Including India, the Asiatic segment has a total population of 464 million, and a population density of 153 per square mile. In addition it has easy access to the Chinese millions. The South and Central American areas have a combined population of approximately one-half million, and an average population of only slightly over three per square mile. The colonial West Indies have a total population of only some four and one-half million, but a population per square mile of over 260. The total population and the population density of Oceania is not known, but both must average fairly low.

Analyzing these figures, we find that all of the potential producing colonies

TABLE V

POPULATION FIGURES FOR POTENTIAL COCONUT-PRODUCING COLONIES*

	Population	*Density per Sq. Mile*
Africa		
French West Africa	14,702,000	8.1
Liberia	2,000,000	46.5
Gold Coast	3,269,000	41.5
Sierra Leone	1,890,000	67.7
Nigeria	19,365,000	57.2
French Equatorial Africa	3,423,000	3.6
Belgian Congo	10,067,000	11.2
Kenya	3,262,000	14.8
Tanganyika	5,147,000	14.0
Mozambique	4,006,000	13.5
Madagascar	3,798,000	16.0
Total	70,929,000	13.4 (average)
Asia		
India	338,172,000	214.7
Burma	14,667,000	62.8
British Malaya	5,137,000	96.5
Ceylon	5,780,000	228.2
Netherlands Indies	64,450,000	87.7
French Indo-China	23,030,000	80.8
Philippine Islands	13,099,000	114.5
Total	464,335,000	153.6 (average)
Central and South America		
British Honduras	56,000	6.5
British Guiana	333,000	3.7
French Guiana	37,000	1.1
Netherlands Guiana	169,000	3.1
Total	595,000	3.2 (average)
West Indies		
Puerto Rico	1,806,000	525.8
British West Indies	2,204,000	174.8
French West Indies	551,000	494.6
Netherlands West Indies	91,000	225.8
Total	4,652,000	265 (average)

*Figures for years between 1931 and 1938.
Source: "Foreign Commerce Yearbook, 1938."

do not have a sufficiently large and dense population for extensive coconut production. This is especially true in view of the fact that the coconut industry is only one of many types of economic activities carried on in most of the countries concerned. In general it may be stated that the population of the South and Central American colonies is both too small in total numbers and too sparse to make those areas outstanding producers of coconut products, even though the whole populace were to engage in that industry to the exclusion of all others. In the case of the colonial West Indies, while the population density is sufficiently great to permit adequate exploitation of available coconut-producing possibilities, yet the total population is only four and one-half million, and only a small fraction of these is engaged in the coconut industry. So far as population is concerned, however, the West Indies offer greater promise of becoming an important commercial coconut center than any other part of the New World. The potential coconut countries in Africa have a fairly large total population, but they are spread over such an enormous area that the population density is quite low. The result is that many possible coconut-producing areas are left undeveloped.

Only in the Asiatic section do we find a favorable combination of dense and large total population. Even excluding India, the population of this section is almost one and one-half times the combined populations of all other potential producing countries, and the density is over six times as great. Including India (and China as a potential labor source), the predominance of the Asiatic section in labor supply is overwhelming. This large total population means that, even though only a small fraction of the people engage in this particular line of economic activity, the resulting production will be extremely large. The great density of population means that the potentialities for coconut production will be utilized to a far greater degree than they would be in a sparsely populated region.

The net result of the population factor is to exclude as major potential coconut producers: (1) the Central and South American colonies; (2) the colonial West Indies, and (3) the potential African areas, and to favor the predominance of the Asiatic areas. This leaves only the Pacific segment to be accounted for.

Oceania, with a few exceptions, is unlike most other potential coconut-

producing countries in that it can produce few alternative crops or products of commercial value. (There are a few exceptions to this statement. Sugar, for instance, is the major crop of the Fiji Islands, and crops or mineral products other than copra constitute the major exports of a few additional islands.) Many of the South Sea Islands are coral reefs or sandy stretches which are suitable for coconut cultivation but absolutely unfit for most other types of crops. Hence, almost the total productive population of Oceania is obliged to engage in commercial coconut production if it wishes to obtain the benefits to be derived from international trade (Table VI). Consequently, despite the relatively small total and the low density of population, one might still class Oceania as a major potential commercial producer of coconuts.

TABLE VI

VALUE OF COPRA AND COCONUT OIL AS PERCENTAGE OF TOTAL EXPORTS, 1936

	Per cent	
Netherlands Indies	7.7	
Philippine Islands	19.6	
Ceylon	8.2	
British Malaya	4.2*	
Oceania		
Solomon Islands	75.6	(av. 1931–35)
Tonga	86.8	
Western Samoa	61.6	
Fiji Islands	19.0**	

*Including reëxports.

**Fiji is one of the exceptional South Sea Islands that depend chiefly on the export of products other than copra (in this case sugar).

Source: International Institute of Agriculture, 1939.

This same situation holds true for many of the smaller islands of the Netherlands Indies, where despite the relatively sparse population the export of copra is great because of the lack of alternative economic pursuits. It does not apply to the larger islands of the Indies Archipelago, where more varied environmental conditions give the occupants a choice of export products.

The competitive crop factor operates in exactly the opposite fashion in the case of the tropical West African region. This section has long been the center for the oil palm, the second most important vegetable-oil plant of the Tropics and an excellent substitute for the coconut palm. Hence, greater apathy to the cultivation of the coconut palm is probably found there than anywhere in the Tropics. It is significant to note that the only parts of Africa supplying appreciable quantities of coconut products to commercial channels are found on the eastern rather than the western coast of that continent (Mozambique, Zanzibar).

In addition to the labor and competitive crop situations, the ethnic factor must here be considered. The Asiatic and Pacific segments of the Tropics are chiefly populated by Malayan and Polynesian races, peoples steeped in centuries of coconut culture and possessing the necessary knowledge and skill for tending the crop. The African and American segments, on the other hand, have a predominant Negroid population which lacks the traditions of coconut culture found in the Orient. The results of this factor, while intangible and difficult to evaluate, undoubtedly tend to foster the commercial coconut industry in the Asiatic-Pacific sections and to retard the industry in Africa and the New World.

Mapping the conclusions arrived at in the discussion of the above factors (Figure 2E), it is found that: (1) the Central American, South American, West Indian, and African potential colonial coastal areas are excluded from becoming major commercial coconut-producing centers because of the labor supply, competitive crop, and ethnic situations; (2) the Asiatic coastal areas remain potential commercial coconut centers because of their large available labor supply and ethnic background, and (3) Oceania compensates for its deficient

labor supply by its ethnic background and by being forced to concentrate on the coconut crop to the almost complete exclusion of all others. The net result is the retention of the Asiatic and Pacific sections as potential major commercial producers of coconuts.

DOMESTIC MARKET FACTOR

In all the areas designated in Figure 2E, the cultivation of the coconut palm is widespread and of great importance. India (including Burma), French Indo-China, Malaya, the Netherlands East Indies, the Philippines, and the South Sea Islands all produce vast quantities of coconuts each year. However, the commercial coconut industry, with its emphasis on exports, is not developed in certain of these areas—particularly India, Java, and French Indo-China. Instead, in these three countries, most or all of the yearly crop is consumed at home. In the remaining areas, copra and coconut oil exports account for a large percentage of the total production.

This situation appears to be largely a function of the relationship between size of population and total area of potential coconut land. If the population of one of the producing countries is excessively large with respect to the available coconut areas in that country, then local consumption of coconut products will account for all or most of the domestic output and little will be left over for export. This is the case in India, Java, and French Indo-China. India's 353 million people form an almost unlimited market for the products of her restricted coconut-producing coastal sections (note small size of potential coconut areas in Figure 2B). Likewise, Java's 42 million people consume most of the coconut products of an island that is but little larger than the state of Ohio, and only limited parts of which are suitable to the production of the palm. Furthermore, while the population of French Indo-China is not excessively large (23 million), yet in relationship to the very restricted coastal coconut-producing areas available (Figure 2B), it is sufficiently great to consume most of the local product.

On the other hand, the relationship between total population and potential coconut-producing land in the remainder of the Oriental Tropics permits the export of large quantities of copra and coconut oil. The Malayan Peninsula has a population of but five million, the island of Ceylon has but six million, all the Outer Possessions of the Dutch East Indies (i.e., all but Java) have a total population of only nineteen million —less than one-half that of Java alone, and the Philippine Islands combined have only thirteen million people. All of these regions are islands or peninsulas, with extremely long coastal coconut areas that have a productive capacity far in excess of local demands (Figure 2B). Hence, all of these regions are major exporters of coconut products.

The population question, therefore, is seen to be critical in the commercial coconut industry. If population is either too sparse in density or too small in total numbers, then coconut output is insufficient to permit a region to rank as an outstanding source of coconut exports. This is the case in almost all the potential colonial coconut-producing areas outside the Oriental Tropics. If, on the other hand, population is too great in comparison with available coconut land, then domestic demands absorb all or most of the local production. This appears to be the case in the Indian, Javanese, and Indo-Chinese portions of the Oriental Tropics. The intermediate population situation that exists in the remainder of the Asiatic and Pacific regions appears to be most

favorable to the export of large quantities of coconut products.

LENGTH OF COASTLINE

It is sometimes stated in geography texts and agricultural works dealing with the subject of coconut production, that the coconut industry is centered in the Orient rather than other parts of the Tropics because the many islands of the East Indies, the Philippines, and the Pacific, as well as the long Malayan Peninsula afford tens of thousands of miles of coast well suited to the growth of the palm. This statement infers that it is merely lack of suitable coastal sites with the necessary climatic and soil conditions that has prevented the development of a large commercial coconut industry in the extra-Oriental Tropics. That such reasoning is fallacious can readily be proved by reference to a few maps and figures.

Ceylon exported, in 1936, a total of 108,000 metric tons of copra and copra-equivalent of coconut oil; British Malaya, during the same year, shipped 152,900 metric tons of similar products (including reëxports). The whole of South America exported only 700 metric tons; the whole of Africa only 74,000 metric tons; the whole of Central America and the West Indies only 5,400 metric tons, during 1936.

However, reference to Figure 2C shows immediately that the coastal areas of both Ceylon and British Malaya are far shorter than the potential coconut-producing coastal portions of Africa, or South America, or Central America and the West Indies. Obviously, if the coastlines of the three non-Oriental areas are each longer than the coastlines of the third and fourth largest exporters of coconut products in the world, then length of coastline by itself cannot be employed to explain the lack of development of a commercial coconut industry in the New World and African areas. If the potential coastal coconut zones of these latter regions were fully employed, they would rank the New World and Africa well up among the leading coconut producers. Factors other than length of coastline must be invoked, therefore, in order to explain the present retarded condition of the industry in those areas. These factors have been previously discussed in this article.

INCORRECT INTERPRETATION OF THE COMPETITIVE CROPS FACTOR

A statement occasionally used in explaining the predominance of the Oriental Tropics in commercial coconut production is: "The great coconut areas are not very well suited for the establishment of other export crops such as coffee, tea, cacao, rubber." This is an incorrect application of the competitive crops factor.

If the "great coconut areas" signify the Oriental coconut-producing countries, one has only to recall the vast tea and rubber exports of Ceylon, the rubber and tin of British Malaya, the sugar and Manila hemp of the Philippines, the rubber and petroleum products of the Netherlands Indies, to understand the inaccuracy of the above statement. Only in Oceania and certain of the smaller of the Dutch East Indies is it true that the environment is "not well suited for the establishment of other export crops."

If, on the other hand, the "great coconut areas" referred to above mean the actual sandy coastal sections of the Oriental producers, then the statement holds true for both non-Oriental as well as Oriental producers. Ideal coconut land is seldom well suited to the growth of other export crops. For instance, most coastal coconut areas experience high winds. Consequently they are usually unfit for a tropical lowland crop

like cacao. Furthermore, the groundwater in many coconut sections is brackish in character, which fact absolutely excludes most other crops. Likewise, some tropical crops such as sugar cane thrive best where a definite and pronounced dry season is part of the climatic regime. These liabilities, however, are not exclusively restricted to the Asiatic-Pacific sections; they occur throughout the potential coconut regions of the world.

Either interpretation of the original statement thus proves it to be incorrect. Hence, the competitive crop factor alone cannot be used to explain the outstanding position of the Orient in the commercial coconut industry.

CONCLUSIONS

The coconut palm (*Cocos nucifera*) shows a circum-equatorial distribution. It is a common coastal tree, and to a lesser extent a tree of the interior, throughout the Tropics. Extensive stands exist in tropical Central and South America, in the West Indies, and in Africa. The widespread presence of the tree in tropical Asia and Oceania is proverbial.

However, the coconut palm, like most other crops, has its half-dozen or so major centers of production, consequent upon the fact that only in narrowly restricted areas is there to be found that almost ideal set of natural and human conditions which result in maximum production with least cost and effort, and which give to those limited areas the necessary advantages to produce leadership.

This study attempts to select and evaluate those environmental, economic, political, and cultural factors which are most significant in accounting for the great concentration of the commercial coconut industry in certain parts of the Oriental Tropics. No claim is made that the factors considered are the only ones involved in the problem, nor is it claimed that the selected factors have been appraised as to their precise function and value. Lack of anything approaching complete data and the fallibility of human judgment prevent such exactitude. Nevertheless, the author does feel that the major factors involved in the localization of the commercial coconut industry have been dealt with more adequately than in any previous publication, and that a more coherent and comprehensive picture of the distribution of the industry has been presented.

DIVIDIVI AND SESAME IN MEXICO

Donald D. Brand

THE Balsas River basin of Guerrero and Michoacan provides the bulk of Mexican dividivi and sesame. In this area maize leads in acreage among cultivated plants, and is the chief foodstuff (followed by beans, chile, and beef), but sesame acreage nearly approaches that of maize. In fact, reduction of plantings of the basic foodstuffs to make way for the cash crop, has not benefited the Balsas farmers, since the high prices of imported maize and beans absorb most of the profits from sesame. Besides sesame, dividivi, and cacahuananche gathered wild, and sugar cane and livestock, by-products provide most of the cash income for the purchase of commodities from outside the Balsas region.

Dividivi or Cascalote

Dividivi (also divi-divi, dibidibi, libi-libi, and libidivi) is the name most commonly applied in commerce to one of the vegetable tannins. These tannins constitute a class of complex organic compounds which interact with proteins in skins so that they will not putrefy, and they likewise alter the skin so that the resultant leather can be wetted and dried without becoming stiff or horny. Tannin or tannic acid is found in some quantity in most plants, with concentrations in the wood, bark, roots, leaves, fruits, or galls. In dividivi the major concentration is in the pods, and secondarily in the wood, although tannin is markedly present throughout the entire plant. According to the Perkin classification, dividivi possesses ellagi-tannin, which leaves a bloom or crystalline deposition that produces firmness in leather but complicates dyeing. Algarrobilla, oak bark, valonia, and myrobalans are other important sources of ellagi-tannins. Estimates of the tannin content of dividivi pods run from 25 to 40 per cent up to 40 to 55 per cent, with a mean of about 35 to 47 per cent. These variations in content estimates represent differences in methods of analysis, and also actual differences of content that have been conditioned by climatic, edaphic, and other environmental factors. In any case, dividivi provides a cheap source of material with a comparatively high tannin content (examples of other average yields are: babul pods 20 to 42 per cent, American chestnut bark 13 to 31 per cent, osage orange wood 11 to 14 per cent, gambier leaves 5 to 8 per cent, valonia acorns 17 to 40 per cent, tanbark oak 10 to 29 per cent, mangrove bark 15 to 48 per cent, sumac 10 to 29 per cent, canaigre root 25 to 30 per cent, myrobalans 12 to 40 per cent, hemlock bark 6 to 7 per cent).

The name dividivi is properly applied only to the small tree *Caesalpinia coriaria* (Jacq.) Willdenow, originally named *Poinciana coriaria* by Jacquin in 1763. This species belongs to the genus *Caesalpinia* (named by Linnaeus after Andreas Caesalpinus, greatest botanist of the sixteenth century), which is classed in the subfamily *Caesalpiniaceae* (*Senna* tribe or family) of the family *Leguminosae*. There are some 60 species of *Caesalpinia*, some in Asia but chiefly in the New World from the Bahamas, Florida, and Lower California to Chile and Argentina. Among important *Caesalpiniae* are the brazilwoods, tari,

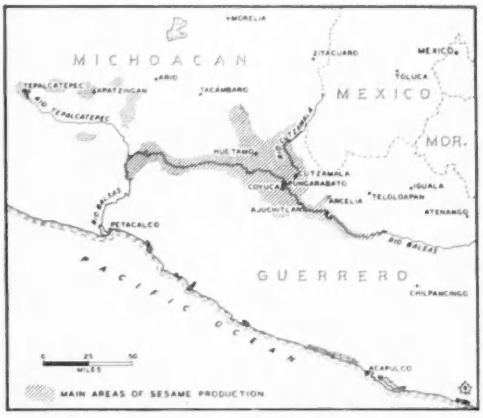


FIGURE 1.—The distribution of sesame production is closely related to relief and the distribution of population. Both sesame and dividivi in Mexico are grown chiefly in the Balsas River basin of Guerrero and Michoacan, an area in which production could be substantially expanded, both in extent and yield.

and algarrobilla. In Mexico there are 24 species of *Caesalpinia*, including ébano, palo colorado, iguano, and tabachín, and two species called cascalote. One of these cascalotes is the true dividivi as known in the Caribbean lands where it was first described scientifically.

In both popular and scientific literature there has been an attempt to restrict the name "cascalote" to *Caesalpinia cacalaco* H. & B. (named in 1809 from specimens collected in Guerrero), which is known only from Mexico (Sinaloa to Oaxaca). This is altogether wrong, since the name is derived from the Aztec "Nacazcólotl" (Nacaztli + cólotl = twisted like an ear), with reference to the twisted mature pod's resemblance to the outline of the human outer ear, which is true of both *C. cacalaco* and *C. coriaria*. Although *C. cacalaco* occupies nearly the same area in Mexico as does *C. coriaria*, and has a high tannin content, its pods seldom enter commerce. This is because the individual *C. cacalaco* trees are not so numerous as *C. coriaria*, and because it is well armed, while *C. coriaria* is lacking in spines. Therefore, when speaking of cascalote tannin in Mexico we are actually discussing true dividivi. There is an apocryphal story that dividivi got its name from David Davis, the captain of the first ship to carry a cargo of pods to Europe, from Venezuela, in the later part of the eighteenth century, but the name is almost certainly of Cumanagua (Venezuela) Indian origin. Various names, such as guatapaná, garrobilla de Curaçao, and libidibi, are applied to dividivi in the West Indies and Caribbean countries of South America, but only Nahuatlan forms (cascalote, nacascolotl, nacascol, nacasolo, etc.) are used in Mexico and Central America.

The cascalote of commerce, then, is derived mainly from *Caesalpinia coriaria*, which grows from Sinaloa and the Bahamas to Colombia, Venezuela, the Guianas, and northern Brazil. It thrives best at fairly low elevations (sea level to 1,000 meters), under hot semi-arid conditions, in areas characterized by tropical savanna (Aw of Koeppen) climate with summer rainfall and nearly dry winters. The main concentrations are in the Pacific coast states of Mexico and Central America, on the leeward side of the West Indian Islands (especially Cuba, Jamaica, and Hispaniola), on the islands off the Venezuelan coast, and on the Goajira peninsula and around Lake Maracaibo. In Mexico, cascalote is a common element in the tropical thorny scrub formations from Sinaloa to Chiapas, and especially in the great basin of the Balsas River, between the volcano-masked southern scarp of the Meseta Central and the Sierra Madre del Sur. Here, in the states of Guerrero and Michoacan, is obtained nearly half of the annual Mexican harvest of about 3,300 metric tons of pods.

The cascalote tree normally grows 10 to 20 feet high, although occasional trees attain to 30 feet. It has a rough

gray bark, linear-oblong bi-pinnate leaves, no thorns, and numerous whitish-yellow flowers in racemes. The pods are thin, smooth, coffee-colored, and about 2 to 3 inches long, with a tendency to assume a double curve resembling the letter S. The smooth brown seeds lack tannin in comparison with the tissue of the pod. Cascalote trees begin bearing about the seventh year, and often attain ages of more than a hundred years. Despite considerable destruction through clearing of fields, and cutting for fuel and lumber (the orange-yellow sapwood and dark heartwood are often used for tool handles, posts, etc.), no attempt at planting has been made in Mexico, although several small plantations have produced well in Venezuela (near Maracaibo and Cumaná), and dividivi has been much planted in India. Insects of the Bruchid family often destroy the pods.

The pods are collected in January and February, usually by raking them off the ground, winnowing out dirt and trash, and placing in sacks for shipment on burro-back to market. One tree will average about 100 pounds of dried pods (33 pounds of tannin), but exceptional trees will sometimes yield more than 300 pounds. Although there is some local use for cascalote in the tanneries of the Balsas area (especially Huetamo, Tacámbaro, Ajuchitlán, Arcelia, Teloloapan, and Iguala), most of it is taken out by pack-animals for use in the large tanning centers of Mexico such as Mexico City, Leon, Guadalajara, Chihuahua, Morelia, and Toluca. Toluca, Iguala, Morelia, and Zitácuaro are the main distributing centers for cascalote from Guerrero and Michoacan, although there is some shipment from the ports of Manzanillo, Petacalco, and Acapulco.

Cascalote is the oldest and most important tannin used commercially in Mexico. Gonzalo Fernández de Oviedo y Valdés, official chronicler of the Indies, 1532–1557, was the first to describe cascalote, though not by name. He mentions (*Historia General y Natural de las Indias*, Lib. IX, Cap. XXVII, p. 356 of Vol. 1, Madrid, 1851; written prior to 1534, and first published 1535 in Sevilla) that in Nicaragua, in the 1520's, the Spaniards made a very

FIGURE 2.—Cascalote grove, near Changata, in the Balsas Valley, Guerrero, Mexico.

good black lasting ink by mixing powdered copperas in water with the pulverized fruit of an unnamed tree. His description of the tree (pods about a half finger's length that dry on the tree and become very twisted; pods used in making black ink) fits cascalote perfectly, which grows and is used in Nicaragua. It is noteworthy that nowhere does Oviedo y Valdés mention dividivi or cascalote being used for tannin, although mangrove is so mentioned. Fray Bernardino de Sahagún also mentions cascalote (*Historia General de las Cosas de Nueva España*, Lib. XI, Cap. XI, p. 289 of Vol. 3, Mexico 1938; written in the 1560's) as *nacazcolotl*, a tree of the Mexican *tierra caliente* whose fruit mixed with copperas produced a very fine ink. Neither does Sahagún mention cascalote as a tannin, although he mentions the use of oak bark. The probable reason for this silence on the part of Oviedo y Valdés

and of Sahagún is that most of the Indians with whom they came in contact (1514–1590) either went naked and unshod, or wore garments and footwear of vegetable fibers, and consequently had little use for or knowledge of tanning. The pre-Columbian Indians of Middle America did tan skins, but not on a large scale. The bulk of this tanning, in Mexico, took place in the highlands where they had many oaks but no cascalote. Fray Alonso de Molina, in his Aztec dictionary of 1571, mentions nacazcólotl, but only as an ingredient of ink. Francisco Hernández, in the 1570's, noted cascalote and its use by the Mexicans of that time. It was, and still is, used not only for tanning, but also for ink (pods, black ink; wood and bark, red ink), as a dye, and as a stomach bitters mixed with cacao. It is doubtful if the Indians of the Balsas area tanned with cascalote pods until the Spaniards occupied the country. In 1579 a Spanish official at Ajuchitlán in the Balsas Valley wrote "the pods are used for a black dye, and to tan hides, and great quantities are taken to Mexico City for this purpose" (*Papeles de Nueva España*, 2nd Series, Vol. 7, unpublished portion on Asuchitlan, manuscript, p. 57).

Normally, the pods and seeds are pulverized and sifted, and the resultant powder is added to water in vats to form the tan liquor. The cascalote tannin contains about two parts of ellagi-tannin to one of gallo-tannin, and often ferments to give a dark reddish stain to the leather. At present cascalote is usually used by itself in small rural tanneries, but in the larger establishments it is often mixed with oak bark, and sometimes with imported quebracho extract. Among tannins consumed in Mexico, cascalote pod is nearly equalled by palo blanco (*Lysiloma candida* T. S. Brandeg., collected in Lower California) bark by gross weight, but actually cascalote provides more tannic acid than all the other domestic sources of tannin combined. The leading vegetable tannins used in Mexico, by gross weight, are: cascalote, palo blanco, oak bark, guamúchil bark (*Pithecollobium dulce* Benth.), imported quebracho, mangrove bark, and huisache (*Acacia* sp.). The Federal District, Guanajuato, Jalisco, and Michoacan lead in the consumption of cascalote, as they do also in all the other important tannins excepting palo blanco (used chiefly in Lower California and Sonora), and mangrove (consumed principally in Vera Cruz, Tabasco, and Sinaloa).

No exact or complete statistics are available on production or trade in dividivi from Mexico or the other producing and exporting areas. It is generally assumed that Mexico has the greatest natural supply of dividivi, and also the largest consumption, among the producing countries. However, Venezuela and Colombia are the largest exporters, followed by the Netherlandish West Indies, Dominican Republic, and Mexico. Venezuela and Colombia each exports between $27,000 and $174,000 annually (with dividivi valued at a little less than two cents per pound), chiefly to Germany, France, the Low Countries, and the United States. The United States used very little dividivi prior to 1913, and still uses little when compared with local chestnut (31 to 36 per cent of entire United States annual consumption of tannin), and imported quebracho (26 to 33 per cent). Since the American chestnut supply is rapidly being depleted by cutting and blight, and since it is cheaper for the tanning and leather-working centers of eastern United States to import foreign tannins rather than develop the hemlock, oak, sumac, and cañaigre of western United States, there is indicated

a steadily increasing import of quebracho, mangrove, and dividivi—all of which can be obtained in ample quantities from Latin America. Mexico alone can supply the entirety of American dividivi demands (at present less than 6,000,000 pounds a year), in addition to her domestic consumption of about 7,300,000 pounds, at an average price of about 1.8 cents per pound. No survey of the cascalote resources of Mexico has ever been made, but an examination of the Balsas Valley by the writer in the summer of 1939 indicated that this valley alone could supply many times the present national production.

FIGURE 3.—Cascalote tree, near El Cubo, in the Balsas Valley, Guerrero, Mexico. (Courtesy of Robert H. Lister.)

SESAME OR AJONJOLÍ

Sesame, familiar to us from the story of Ali Baba and the Forty Thieves, and as a decorative ingredient of certain breads and confections, is one of the oldest cultivated plants in the world, and is certainly the most ancient cultivated source of oil. From great antiquity it was cultivated in Iran, Mesopotamia, India, and Egypt, where its oil was used in cooking, for anointing the body, and for heat and illumination. In time sesame spread to the East Indies, China, and Japan, and westward across Africa and throughout the Mediterranean lands. Since the Spaniards had been familiar with sesame (sésamo or ajonjolí) for centuries at the beginning of the sixteenth century, we may assume that it was among the many unspecified herbs and garden plants introduced into the West Indies between 1492 and 1521. The date of introduction into Mexico has not been determined as yet, but probably many of the religious planted sesame in their monastic gardens in order to obtain a local supply of oil. The cultivation of sesame did not spread rapidly nor become common in New Spain because the owners of large haciendas were concerned with the commercial staples of the time, such as sugar cane, indigo, and cacao, and the small farmers (mainly Indians and mestizos) continued to plant the chia (*Salvia chia* Fernald), cotton, and pumpkins whose seeds had provided oil to pre-Spanish Mexico. Although now the leading cash crop of the middle Balsas Valley, which produces the bulk of the Mexican crop, sesame is not mentioned in the sixteenth and seventeenth century literature on that area. Whatever the date that ajonjolí may have been introduced into the Balsas region, certainly it did not become of much importance until the establishment of the Mexican republic. This was conditioned by the fact that sesame was not a colonial raw product needed in mercantile imperialistic Spain. By 1870 sesame had become one of the four most valuable crops of the middle Balsas area (southeastern Michoacan, and northwestern Guerrero).

The relative and absolute importance of sesame in the Balsas area and in Mexico did not change radically until the World War of 1914–18. Then acreage and production increased rapidly, followed by a more or less static period in the 1920's, and another spurt commencing in 1934. Tables I and II illustrate the recent trends in Mexico.

TABLE I

SESAME PRODUCTION IN MEXICO

Year	*Metric Tons*
1900	3,510
1901	9,874
1902	1,231
1903	2,745
1904	2,590
1905	5,486
1906	5,903
1907–1919	No precise data
1920	7,850
1921	4,619
1922	4,092
1923	11,519
1924	6,459

TABLE II

RECENT TRENDS IN MEXICAN SESAME PRODUCTION

Year	*Area in Hectares*	*Production in Metric Tons*	*Value in Pesos*
1925	21,391	10,045,140	1,324,025
1926	23,592	11,169,214	1,424,907
1927	24,555	12,235,637	1,625,207
1928	24,971	14,973,113	2,026,608
1929	24,419	10,542,201	1,336,995
1930	28,342	7,702,300	935,007
1931	33,665	15,071,497	1,611,323
1932	30,824	15,814,301	1,914,791
1933	32,184	12,560,680	1,915,231
1934	38,087	14,555,998	2,263,859
1935	39,546	18,889,710	2,706,389
1936	59,533	25,059,982	5,069,153
1937	68,717	26,847,117	6,887,000
1938	60,393	25,708,238	5,650,000
1939	61,156	33,196,000	.....

The oscillations in planting and production represent the interaction of such factors as: quantity of local crop of cotton and resultant price of cottonseed oil; world prices of lard, vegetable oils and fats, margarine, and copra, and accompanying imports into Mexico; import duties levied on competitive oils and fats; and local Mexican production and price of sesame. The period 1931–35 saw the combination of fair to poor crops of local Mexican competitors of sesame, with the increased application of tariffs intended to protect and subsidize Mexican production of fats and oils. The relatively poor 1933 sesame crop in Mexico and resultant increase in price accentuated the big increase in acreage in 1934. More recently the Spanish Revolution and the Second World War have reduced the competition of imported olive oil, various other oils and fats from Europe, and soap. This favorable condition for Mexican sesame and sesame oil has been offset only partially by low prices and increased imports of copra from the Philippines and elsewhere.

The bulk of Mexican production has been in the states of Guerrero and Michoacan. These two states always occupy the first two places in Mexican production, and normally account for more than two-thirds of the acreage and production. Table III shows the production of sesame in the leading ..tes, 1925 to 1939. Until 1933 Guerrero and Michoacan produced more than ninety per cent of the Mexican crop of sesame seed. Other producing states, of intermediate importance and in the order of total production during the period 1925–1939, are Sinaloa, Vera Cruz, Sonora, Oaxaca, Mexico, and Puebla. Also, small acreages are devoted to sesame in Tabasco, Nuevo Leon, Colima, Coahuila, San Lúis Potosí, Chiapas, Hidalgo, Jalisco, Tamaulipas, Yucatán, Morelos, and Campeche, in approximately that descending order.

During the period 1925–39, approximately eighty per cent of Mexican production came from the greater Balsas basin, including southwestern Puebla, southern Morelos, and southwestern Mexico, as well as the main area in Guerrero and Michoacan. The main area, between Atenango del Rio on the east and Tepalcatepec on the west, has produced nearly 79 per cent of the Mexican total. Virtually all of the Michoacan production comes from the districts of Huetamo, Apatzingán, Ario de Rosales, Zitácuaro, Morelia, Arteaga, and Tacámbaro in the Balsas drainage. Between 55 and 60 per cent of Guerrero's

TABLE III

SESAME PRODUCTION IN METRIC TONS, 1925–1939, BY STATES PRODUCING MORE THAN 50 TONS

1925		*1926*		*1927*	
1. Michoacan	5,140	1. Michoacan	5,460	1. Michoacan	6,410
2. Guerrero	4,286	2. Guerrero	5,008	2. Guerrero	5,317
3. Vera Cruz	213	3. Vera Cruz	239	3. Vera Cruz	225
4. Mexico	172	4. Puebla	118	4. Mexico	84
5. Puebla	85	5. Mexico	100	5. Puebla	64
		6. Colima	91		
1928		*1929*		*1930*	
1. Michoacan	8,363	1. Michoacan	5,714	1. Guerrero	4,487
2. Guerrero	5,615	2. Guerrero	3,801	2. Michoacan	2,440
3. Vera Cruz	381	3. Vera Cruz	401	3. Vera Cruz	360
4. Puebla	181	4. Oaxaca	126	4. Mexico	124
5. Sonora	126	5. Sinaloa	116	5. Sinaloa	88
6. Sinaloa	100	6. Puebla	112	6. Puebla	80
7. Mexico	56	7. Sonora	100	7. Oaxaca	75
8. Oaxaca	51	8. Mexico	99		
1931		*1932*		*1933*	
1. Guerrero	7,866	1. Guerrero	8,387	1. Guerrero	5,972
2. Michoacan	5,950	2. Michoacan	5,914	2. Michoacan	3,774
3. Oaxaca	399	3. Vera Cruz	479	3. Sinaloa	1,139
4. Vera Cruz	358	4. Oaxaca	397	4. Vera Cruz	631
5. Mexico	152	5. Mexico	161	5. Oaxaca	270
6. Sinaloa	133	6. Sinaloa	157	6. Sonora	231
7. Puebla	84	7. Puebla	108	7. Mexico	158
8. Sonora	60			8. Puebla	134
				9. Colima	96
				10. Nuevo Leon	79
1934		*1935*		*1936*	
1. Guerrero	6,021	1. Guerrero	8,597		
2. Michoacan	4,639	2. Michoacan	5,274		
3. Sinaloa	1,658	3. Sinaloa	1,146		
4. Vera Cruz	904	4. Vera Cruz	823		
5. Oaxaca	377	5. Oaxaca	561	(Information not in hand)	
6. Sonora	261	6. Colima	265		
7. Puebla	194	7. Puebla	202		
8. Mexico	151	8. Sonora	160		
9. Tamaulipas	132	9. Mexico	120		
10. Colima	110				
1937		*1938*		*1939*	
		1. Michoacan	9,272	1. Guerrero	11,956
		2. Guerrero	7,530	2. Michoacan	11,525
		3. Sonora	3,200		
		4. Sinaloa	2,406		
(Information not in hand)		5. Vera Cruz	1,617	(Data for other states not in hand)	
		6. Oaxaca	1,002		
		7. Tabasco	160		
		8. Nuevo Leon	111		
		9. Mexico	108		
		10. Colima	94		

sesame seed is produced in the Balsas districts of Mina, Montes de Oca, Aldama, Bravos, Alvarez, Guerrero, and Hidalgo; the remainder comes from the coastal districts of Tabares, Galeana, Allende, and Abasola. The coastal area west of Acapulco, locally known as the Costa Grande, is the chief sesame district along the seaboard. The adjacent districts of Mina in Guerrero and Huetamo in Michoacan normally produce about one-half the total yield of the two states. See Table IV for recent production by municipalities and districts.

In both Michoacan and Guerrero sesame is one of the more valuable crops, usually ranking fifth to seventh in value after such as maize, cotton, wheat, sugar cane, rice, and beans.

Within the middle Balsas Valley sesame ranks below only maize, and is the chief source of cash and credit from the outside. Within Mexico as a whole the sesame crop does not play a highly important rôle, normally being worth less than 15 to 20 other crops. However, the sesame crop is often worth more than that of chickpeas, barley, coconuts, tobacco, grapes, watermelons and melons, pineapples, sweet potatoes, cacao, onions and garlic, peanuts, etc.

Sesame (*Sesamum indicum* L., or *S. orientale* L.) is an herbaceous annual which belongs to the small family of *Pedaliaceae*, native to the Old World. The genus *Sesamum* contains some twenty species, which are native to south and eastern Africa, and south and eastern Asia. The various names (bene, gingili, til, sesame, ajonjolí, etc.) are all derived from Asiatic languages, principally Semitic and Indo-Iranic.

FIGURE 4.—Sesame field in flower. The field is about one-fourth mile from the Balsas River between Changata and Amuco in Guerrero.

Under sub-tropical conditions sesame normally grows to a height of between two and five feet, but under optimum tropical conditions the plant often attains heights of between five and ten feet. Leaves are lanceolate-oblong, slightly hairy, and three to five inches long. Flowers are white to violet in color, and hermaphrodite. In the Balsas basin the most common variety has whitish violet flowers. The fruit is an oblong bilocular capsule, about an inch and a quarter in length, with two rows of seeds on each side. The seeds are numerous, oval to triangular, compressed or flattish, and about two millimeters in length. Seed color varies from pale yellow, through dark red and brown, to black. Climate, elevation, and soil, as well as varietal strain, affect seed and flower color, and size of leaf and plant.

The most common varieties cultivated in the Balsas Valley and in Mexico are the brown seeded *trigueña* (*morena*), the *criolla* (*blanca*) with cream colored seeds, and the dark seeded *negra*. The light colored seeds of the *criolla* are favored for decorating breadstuffs, and for yielding light colored table oils. The *criolla* requires four to five months to mature, and is very demanding on the soil. The *trigueña* seed produces a dark oil that finds its chief use in soaps; but despite darker color and poorer yield than the *criolla*, its short growing period of only three months and its lesser demands as to soil and climate make the *trigueña* widely popular over the Balsas basin and over most of Mexico. Recently the Mexican government has introduced new varieties into cultivation, one of which is colloquially called the *Cardenista*.

In general sesame does best under moderately humid tropical conditions with a dry planting season, followed by a rainy hot growing period, and a

comparatively dry maturing and harvesting period. Sesame is not profitable in windy areas, since high winds often "thresh" the seed-pods in the field. A porous friable sandy loam, rich in phosphates and potash, and moderate in lime content, is best; and such a soil is found over much of the middle Balsas basin which is a structural depression with a varying veneer or fill of recent alluvial and colluvial materials. In the Balsas areas the stages of sesame cultivation are as follows: the field, normally level or slightly undulating, is cleared with the straight machete or *bolo* and the curved machete or *garabato*. In the newly cleared fields the ashes of the cut-down vegetation afford the only fertilizer; and thereafter, although sesame makes heavy demands on the soil, normally the only manure is from the livestock that graze the fields after harvest. Home-made wooden plows, normally with a small iron point or share, drawn by oxen, turn over the soil, which may be harrowed before the seed is checked in in rows two to two and a half feet apart. Most of the sesame in the Balsas area is planted in rows, but some is sowed broadcast. Amounts of seed planted per hectare vary from six to 36 kilograms, according to method of planting and whim of the farmer. The average runs 10 to 12 kilograms, when planted in rows. The bulk of sesame is sown in middle June, and ripens and is harvested in September, October, and even into November and December. Plants appear seven to ten days after seeding. Then follows replanting, thinning, and weeding. The Balsas farmers weed and cultivate with a long-handled hoe with a triangular blade of iron which has its plane in the same axis as that of the handle. This *tarecoa* is used with a thrusting motion. Practically all of the sesame is in *temporales*, since little irrigation is practiced in the Balsas Valley.

FIGURE 5.—Sesame field near Huetamo, in Michoacan. (Courtesy of Douglas Osborne.)

On ripening, the fruit turns reddish, and the stalks become yellowish, the leaves shrivel and fall. Different capsules on the same plant ripen at different times, but in order to prevent loss of seeds from capsules opening in the field the entire plant is reaped with a machete before complete maturity, and left to mature on a threshing floor. Threshing is completed by beating the sesame plants with rods over mats, and the seed is winnowed from the straw by throwing the threshed residue into the air. No threshing or winnowing machinery is used in the Balsas area. The average yield for Mexico during the period 1925 to 1938 has been 442 kilograms per hectare, with a high of 599 kilograms in 1928 and a low of 272 in 1930. Nearly the same average holds for the Balsas Valley, but the range in the Michoacan portion has been from 206 to 490 kilograms, and in Guerrero from 314 to 565 kilograms. This low average yield, which should be between 700 and 1,200, and in exceptional cases could exceed 2,000 kilograms per hectare, is due to *temporal* (dry) farming, impoverishment of soil (there is little or no crop rotation, as well as little manuring), and generally crude methods of cultivation and harvesting. Sesame has but few pests.

TABLE IV

SESAME PRODUCTION 1938 AND 1939, BY LEADING MUNICIPALITIES IN GUERRERO AND MICHOACAN

Municipality (township)	*District (county)*	*1938 prod. in Met. T.*	*1939 prod. in Met. T. (Prelim. figures)*
Huetamo	Huetamo, Mich.	2,840	2,840
Parácuaro	Apatzingán, Mich.	2,100	2,100
Cutzamala	Mina, Gro.	1,162	1,450
Acapulco	Tabares, Gro.	932	?
La Huacana	Ario de Rosales, Mich.	880	566
Apatzingán	Apatzingán, Mich.	828	248
Villa Madero	Morelia, Mich.	780	780
Petatlán	Galeana, Gro.	704	400
Coyuca de Catalán	Mina, Gro.	693	1,210
San Lucas	Huetamo, Mich.	680	2,700
Ajuchitlán	Mina, Gro.	648	784
Tepalcatepec	Apatzingán, Mich.	540	480
Coyuca de Benítez	Tabares, Gro.	450	580
Coahuayutla	Montes de Oca, Gro.	442	50
Zirándaro	Mina, Gr.	414	2,200
Cuautepec	Allende, Gro.	414	994
Buenavista Tomatlán	Apatzingán, Mich.	360	?
Tlalchapa	Mina, Gro.	280	?
Benito Juárez	Galeana, Gro.	250	171
Arcelia	Aldama, Gro.	225	255
Tuzantla	Zitácuaro, Mich.	217	960
Azoyú	Allende, Gro.	210	80
Pungarabato	Mina, Gro.	200	193
San Marcos	Tabares, Gro.	175	1,092
Arteaga	Arteaga, Mich.	148	690
S. M. Totolapan	Mina, Gro.	19	416
Tecpan	Galeana, Gro.	...	660
Atoyac	Galeana, Gro.	...	360

Sesame is not much used locally in the Balsas region of production. Small amounts are consumed on confections and seedcakes, and a little is fed to fowls, but the great bulk is sold to outside buyers, merchants, and oil mills in the larger towns of the area, such as Iguala, Huetamo, Pungarabato (Ciudad Altamirano), Cutzamala, Coyuca, Tacámbaro, Ario, Tlapehuala, Arcelia, Ajuchitlán, and Tepecoacuilco. The producers have obtained from 11 centavos (1931) to 26 centavos (1937) a kilogram, but the average in the Balsas towns is between 13 and 15 centavos. Thus the average farmer grosses about 62 pesos a hectare, with a possible net profit of about 20 pesos. Both sesame seed and oil are shipped out of the Balsas area, chiefly from the concentration centers of Huetamo and Cutzamala to oil mills and soap factories in Morelia, Zitácuaro, Querétaro, Toluca, and Mexico City in the highlands, by pack animals, and from Iguala on the railroad and paved highway to the Federal District and states of Mexico and Puebla. There is some export, via the Balsas River and the Acapulco highway, from the ports of Petacalco, Sihuantanejo, and Acapulco.

Only a small part of the Mexican sesame crop is used directly for human and poultry food, and the greater portion is converted into oil. Sesame-seed oil is semi-drying and edible, like that of maize, cottonseed, and sunflower. It is a "virgin oil," i.e., edible when cold pressed, like the oil of the olive, peanut, poppy, rape, etc. This sesamum oil is composed of 12 per cent palmitic and stearic acids, and 88 per cent of oleic and linoleic acids. It has almost no odor, is practically tasteless although slightly sweetish, does not become rancid easily, has a specific

gravity of .92, and solidifies at −5 degrees Centigrade. The oil yield of sesame by weight is very high, ranging between 35 and 57 per cent, with an average of about 44 to 50 per cent. Analyses of sesame seed have run: 6 to 22 per cent roughage, 5 per cent water, 4 to 8 per cent ash, 35 to 62 per cent carbohydrates, and 20 to 22 per cent protein. The calory value of sesame oil is about 583. The first cold pressing yields 22 to 32 per cent of fine table oil, which may be transparent to pale yellow and amber in color. This is sometimes made to imitate olive oil (greenish-yellow in color) by use of sulfuric and nitric acids. The second cold pressing, with water added, yields 6 to 12 per cent of second-grade table oil. A third pressing, hot with water, produces 8 to 10 per cent of an oil used in soap manufacture. Sometimes a fourth pressing is made of the oil cake mixed with carbon disulphide, which nets another 8 to 10 per cent of oil for use in soaps. When the oil has been so completely removed the residual cake is good only for fertilizer; but this excessive extraction is not normally carried on in Mexico, and the oilcake is used as stock feed.

During the last four years of complete statistics (1935–38), about 71 per cent of the sesame seed harvested in Mexico has entered oil mills. It is assumed that the remainder is used directly for food and for planting seed. The oil, if high grade (first pressing), is used for table purposes, i.e., olive oil adulterant, false olive oil (treated with acids for color, and a little real olive oil added for flavor), salad oil, mayonnaise, vegetable butter (margarine), etc. First pressing oil, and also oil from the second pressing, is used in cooking, especially in vegetable lards. The inferior oils, obtained from third and fourth pressings, are used principally in soaps, although the better grade soaps and perfumes include oil of the earlier pressings. Foods, condiments, and sauces, together with soaps and perfumeries, utilize most of the sesame oil marketed. So far, in Mexico, there has not been much use of sesame oil in rubber substitutes, lubricants, medicines, illumination, etc.

It has been stated repeatedly that the bulk of Mexican sesame oil enters into the manufacture of soap. The last statistics available (Second Industrial Census of 1935, published 1937 and 1938) do not indicate this. In 1934 there were produced 6,830 metric tons of sesame oil; 2,325 metric tons were used in the vegetable butter and lard industry; and but 1,175 metric tons were used for soap. It is possible, of course, that some of the soap factories purchase sesame seed and elaborate their own oil. Sesame oil, used alone, does not make a very good soap (sesame oil has a saponification value of 188–193, as compared with cottonseed [192–200], palm oil [196–206], palm kernel oil [240–250], and coconut oil [251–264].) However, mixed with cottonseed oil sesame oil provides a good soap, and the mixture of sesame oil and coconut oil yields an outstandingly fine soap.

Since oil is the chief product of sesame, the position of sesame oil among the other vegetable oils should be considered. Table V presents recent comparative material. The Mexican vegetable oil industry is based upon domestic cottonseed, imported copra, and domestic sesame. These three have dominated the picture for many years. The other vegetable sources, especially peanut, castor bean, and coquito palm nut, have dropped greatly in the past seven years. Linseed barely has maintained its place in official statistics; but turnip, rape, and chia have been dropped for several years; and such oil plants

TABLE V

[1]MEXICAN PRODUCTION OF VEGETABLE FATS, 1925 TO 1938

A. Metric Tons Raw Materials Used

	1925	*1926*	*1927*	*1928*	*1929*	*1930*	*1931*	*1932*	*1933*
Cottonseed	.....	.....	.....	.....	.....	.....	.....	.....	.....
Copra, Mexican[2]	.....	.....	.....	.....	.....	.....	.....	.....	.....
Copra, imported[2]	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sesame seed	.....	.....	.....	.....	.....	.....	.....	.....	.....
Peanut	.....	.....	.....	.....	.....	.....	.....	.....	.....
Castor bean	.....	.....	.....	.....	.....	.....	.....	.....	.....
Coquito palm nut[3]	.....	.....	.....	.....	.....	.....	.....	.....	.....
Linseed	.....	.....	.....	.....	.....	.....	.....	.....	.....

B. Metric Tons Oils and Fats Produced

Cottonseed oil	13,137	23,580	11,746	18,348	16,122	11,632	13,766	6,654	16,883
Coconut oil	10,200	10,200	10,471	10,376	10,391	10,669	10,614	10,610	11,029
Sesame oil	4,219	4,691	5,139	6,289	4,428	3,235	5,633	6,642	5,173
Peanut oil	2,113	2,312	2,192	2,064	1,555	1,238	1,240	1,330	1,956
Castor oil	.....	.....	.....	.....	.....	.....	.....	.....	.....
Coquito oil	.....	.....	.....	.....	.....	.....	.....	.....	.....
Linseed oil	316	321	585	297	261	293	421	1,238	541

C. Value, in Thousands of Pesos, of Oils and Fats

Cottonseed oil	.....	.....	.....	.....	.....	.....	.....	.....	.....
Coconut oil	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sesame oil	.....	.....	.....	.....	.....	.....	.....	.....	.....
Peanut oil	.....	.....	.....	.....	.....	.....	.....	.....	.....
Castor oil	.....	.....	.....	.....	.....	.....	.....	.....	.....
Coquito oil	.....	.....	.....	.....	.....	.....	.....	.....	.....
Linseed oil	.....	.....	.....	.....	.....	.....	.....	.....	.....
Other oils[4]	.....	.....	.....	.....	.....	.....	.....	.....	.....

[1] Figures are dependable only since 1934.

[2] Copra is the only source of vegetable oil which is imported in any commercial quantity.

[3] Coquito palm nut is the most important of the wild oil sources.

[4] Other oils include turnip, rape, mustard, sunflower, chia, cacahuananche, argemone, poppy, maize, hemp, kapok, olive, etc.

as mustard, sunflower, poppy, hemp, maize (for oil), cacao (for oil), and olive are but little cultivated. It is worthy of remark that in 1936 only 36 metric tons were harvested of chia, once the leading Mexican oil plant. In addition to the coquito palm nut, and some of the local coconut crop, practically all of the oil from cacahuananche (*Licania arborea* Seem.), argemone, kapok, and a variety of native palms is from the wild plants.

In practically every respect sesame oil is third among Mexican vegetable oils. This is true of tonnage of raw materials used, net tonnage of oil produced, and value of the oil. The vegetable oil industry ranks 16th (1935 Industrial Census) among Mexican industries by value of its products, and 37th in number of workers employed. The number of vegetable oil mills (with annual products worth 10,000 pesos or more) is now (1939) 51, a slight drop from the 69 reported in 1934. In 1929 there were listed 114, but that census was not exact. Jalisco (8), Oaxaca (8), the Federal District (7), Michoacan (7), Coahuila (7), Guerrero (4), and Puebla (4) lead in the number

1934	1935	1936	1937	1938
.....	73,426	110,654	99,247	109,234
.....	3,106	1,640	1,523	2,413
.....	12,380	23,582	24,046	30,878
14,059	16,724	16,276	17,228	17,892
.....	.....	3,835	2,166	3,155
.....	.....	1,167	523	511
.....	.....	1,411	889	267
.....	.....	856	580	355
16,735	11,321	16,949	14,671	17,023
12,115	10,877	15,697	16,035	20,370
6,830	8,207	7,397	7,791	8,202
1,957	.....	541	522	753
.....	.....	576	235	267
.....	.....	706	362	165
499	.....	266	184	116
6,032	4,747	8,797	9,106	9,860
5,687	4,261	8,974	10,657	12,907
3,093	3,847	4,332	6,066	5,215
283	.....	310	399	486
161	.....	254	90	109
.....	.....	369	234	106
286	.....	124	127	64
.....	2,678	143	306	180

of mills. Of the 69 mills listed for 1934, 14 worked copra, 12 used only sesame, 9 elaborated cottonseed, and 19 used several oil plants. By total value of all oils, Coahuila (cottonseed chiefly) is first, followed by the Federal District (mixed), Durango (cottonseed), Sinaloa (mixed), Michoacan (chiefly sesame), and Guerrero (chiefly sesame). In the production of sesame oil, the Federal District and Michoacan lead, followed by Guerrero, with Vera Cruz a very poor fourth. Outside of the Federal District the larger sesame oil mills are to be found in Morelia, Zitacuaro, Huetamo, Tacambaro, and Ario in Michoacan, and in Iguala, Pungarabato, Cutzamala, and Coyuca in Guerrero.

Much of the sesame oil (35 to 40 per cent) is used in vegetable lard and butter, and in refined oil industries. There are 15 such establishments in Mexico, six of which are in the Federal District, Michoacan, and Guerrero. Nearly 62 per cent of Mexican vegetable lards and butters are made from cottonseed oil in northern Mexico; about 24 per cent are manufactured from sesame oil, mainly in the Federal District and Michoacan; and coconut oil is a poor third with about 13 per cent.

The soap industry provides the best known demand for sesame oil. In 1934 there were 106 soap factories (with annual products worth 10,000 pesos or more) in Mexico. The Federal District led with 21; Jalisco had 13; Guerrero 8; Michoacan 7; and Coahuila, Puebla, and Vera Cruz 5 each. By value of raw materials and of products, the Federal District ranked first, with the cottonseed oil states of Durango, Coahuila, and Nueva Leon following. The great bulk of Mexico's soap is manufactured in Mexico City and in Torreon, followed distantly by Guadalajara and Merida, and such towns as Queretaro, Monterrey, and Puebla. Because of certain superior qualities coconut oil is most used in making soap, followed by cottonseed oil, sesame oil, palm oils, olive oil, and castor oil in that order. The Federal District uses more than half of the sesame utilized for soaps, with Queretaro a poor second, then Mexico, Michoacan, Guanajuato, Guerrero, and Vera Cruz.

Although sesame was introduced into Mexico from the Old World, it has succeeded so well in recent years that now Mexico ranks between fifth and eighth in both acreage and production. In the past ten years Mexico has advanced from twelfth to sixth in production, passing Greece, Nigeria, Uganda, Belgian Congo, the USSR, and Pales-

tine, to rank behind China, India, Burma, Turkey, and the Anglo-Egyptian Sudan. Mexico leads not only Latin America, but all of the New World in both acreage and production. However, the absolute figures are not impressive since Monsoon Asia (China, India, Burma) produces nearly 77 per cent of the world's total. It has been estimated that in 1936–37 China and India together produced 12,462,000 quintals (1 quintal = 100 kilograms = 220.5 pounds) out of a world total of about 16,800,000 quintals. Despite Mexico's production rank, there is seldom any surplus for export. In fact Brazil exceeds Mexico in net exports. All of Latin America together (chiefly Mexico, Brazil, Cuba, Argentina) has a slight export surplus of about 2,000 quintals. Asia leads in net exports with 772,000 quintals, followed by Africa. North America and Europe have net imports of 664,000 and 618,000 quintals.

During the period 1925 to 1939, Mexico has exported 787 metric tons, worth 177,000 pesos, chiefly to the United States and Cuba. During this same period Mexico has imported more than she has exported, mainly from the United States; but since 1932 Mexico has had a slight net export surplus. Mexico has been able to attain this net surplus because the Mexicans are not a butter or margarine or oil eating people (as were the Iberian ancestors of many), and an average per capita production and consumption of one and a fraction pounds of sesame oil has been sufficient. However, it must be recalled that Mexico has a large cottonseed production, and a growing import of copra.

CATTLE INDUSTRY OF NEW MEXICO

James I. Culbert

FOR almost four centuries, the raising of beef cattle has been an important industry in New Mexico. Cattle are not native to the Americas, but were introduced by Spanish settlers into the southwestern region, first settled of any of the present United States. The Onate expedition, setting out from Mexico to colonize the Rio Grande Valley, brought with it 7,000 head of stock of all kinds, and before the Indian revolt of 1680, cattle ran at will over the ranges of New Mexico.

History

While under the rule of Spain 90 per cent of the settlements of New Mexico were located in the valley of the Rio Grande. The colony was remote from the rest of the world and was separated from Vera Cruz and Chihuahua, the centers of trade, by a vast expanse of desert. The trade of the colony was chiefly in the products of mountain and ranch: sheep, wool, hides, furs, deerskins, and buffalo robes. For more than two hundred years New Mexico was isolated by nature and Spanish law, and it was not until after Mexican independence that trade with the United States began over the Santa Fe Trail.

The cattle industry remained in a primitive and undeveloped state until New Mexico was annexed to the United States, for the great grasslands of the high plains could not be used, nor grazing prosper, until the Indians had been subdued. During the years of the gold rush large herds of cattle were driven to California annually, but rapid growth of the cattle industry did not begin until after the Civil War. At the close of the war there were a large number of Union soldiers and about 10,000 Navajo Indians located at Fort Stanton. Texas cattle were driven into the territory to supply the Fort with beef. During succeeding years, other herds were driven across northern New Mexico into Colorado where a mining boom had caused a great increase in population. After 1878, when the railroads which had been inching across the plains reached New Mexico, bringing new settlers and opening the markets of the east to cattlemen, it was no longer necessary to trail cattle long distances to market, and the practice of trail driving was discontinued. So great had been the growth of the cattle industry during these years, that by 1880 the public domain of northeastern New Mexico was already overstocked.

Physical Conditions

There are a number of conditions which account for the continued importance of an essentially frontier industry in present-day New Mexico. Chief among these are the geographic factors of relief, altitude, and climate, with their resultant soils and vegetation. Economic factors, such as transportation facilities, and location with respect to market have also played an important rôle in determining the utilization of lands of the state.

Topography

New Mexico has an area of approximately 122,503 square miles. Its greatest length from north to south is 385 miles, and the greatest width from east to west is 352 miles. The surface of the

state presents a varied and uneven appearance, with large areas of plain and plateau broken by mountain ranges or isolated groups of mountains, and cut by numerous canyons. Elevations range from 3,000 feet in the southeast, where the Pecos River leaves the state, to more than 13,000 feet among the high peaks of the Sangre de Cristo Range in the north.

The principal mountain region lies in the north-central part of the state, where the Sangre de Cristo Range extends from Colorado southward for 140 miles, breaking off sharply south of the city of Santa Fe. This is a region of high relief, with many mountain peaks, rugged uplands, and narrow rocky canyons. West of the Rio Grande, and parallel to the Sangre de Cristo, the Naciemiento and Jemez ranges have a similar topography although elevations are lower.

Southward through the center of the state are ranges of block fault mountains separated from each other by desert basins such as the Jornada del Muerto, and the Tularosa Valley. Between these ranges and the valley of the Pecos, which lies to the east, there is a high plateau faulted and dissected into rugged, almost mountainous relief, particularly in its southern section.

The great plains extend from the Rocky Mountains to the central lowland. Near their western border, where the elevation is between 6,000 and 7,000 feet, the plains are dissected and the region is characterized by deep canyons and high mesas. In the extreme eastern part of the state, the Llano Estacado or Staked Plains, constitute an area which has been described as one of the flattest expanses in nature. In elevation, the Staked Plains range from 5,000 feet in the north to 3,000 feet in the south. A large part of the surface is untouched by erosion, and there are neither gullies nor stream courses. There are, however, numerous saucer-like depressions which become lakes during the wet season. Between the Llano Estacado and the mountains, the Pecos trough has been eroded below the elevation of the plains. Its boundaries are marked by steep slopes from 500 to 1,000 feet high, but within the boundaries topography varies from flat plains to rugged canyons.

The western and northwestern portion

FIGURE 1.—A herd of pure blooded Herefords grazing on the Mexican Springs Demonstration Area. McKinley County, western New Mexico. (Courtesy of U. S. Soil Conservation Service.)

of the state is a region of high plateaus ranging in elevation from 5,000 to 7,000 feet. Mesas, canyons, and dry washes are prominent topographic features. Washes, flat-floored valleys enclosed by steep sides and from one to five miles in width, are characteristic of the region. Many wide shallow valleys are entrenched by steep, narrow canyons.

DRAINAGE

The Continental Divide, separating the waters flowing to the Gulf of Mexico from those flowing to the Gulf of California, forms an irregular line across the western part of the state. East of this line are the three principal rivers of the state: the Rio Grande which rises in southern Colorado, and almost bisects the state; the Pecos, which has its headwaters in the high peaks of the Sangre de Cristo and runs in a southeasterly direction; and the Canadian, which flows eastward from the mountain parks of northern New Mexico. On the west, the Gila and the San Juan reach the Gulf of California by way of the Colorado.

There are a number of areas of internal drainage in the state. The most important of these bolsons are Tularosa and Estancia valleys east of the Rio Grande, and the plains of San Augustin in the west.

CLIMATE

In general, the climate of New Mexico is characterized by a large amount of sunshine, low relative humidity, and a rather great diurnal range of temperature at all seasons of the year. Over most of the state precipitation is light and variable and occurs during spring, midsummer, and early fall. Because of the great differences in altitude in various parts of the state, and local conditions due to the presence of mountains, both temperature and precipitation vary greatly within short distances.

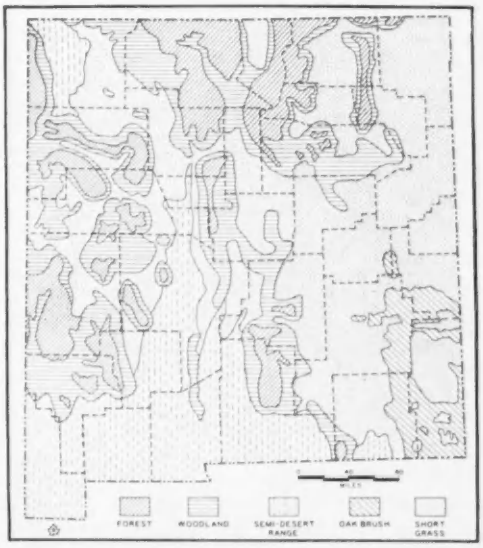


FIGURE 2.—Types of grazing areas in New Mexico. (Adapted from Bureau of Agricultural Economics, Neg. 35040.)

The highest temperatures occur in the lowlands of the south, in the lower Rio Grande and Pecos valleys, and in certain of the intermontane basins. There is a close correlation between temperature and altitude, and as altitude increases from south to north, temperatures decrease. On the southern border of the state, El Paso, Texas, has an average annual temperature of 63 degrees; in the central part of the state, and at a higher elevation, Santa Fe reports a temperature of 49 degrees; while the mountainous regions of the north have average temperatures below 40 degrees.

Along the southern border, maximum temperatures of over 100 degrees are common, but in the mountains extremely high temperatures are seldom encountered. Even in the south, nights are usually cool and heat is not oppressive because of the low humidity. No part of the state is entirely free from frost and snow, but excepting in the

FIGURE 3.—A bunch grass–mixed grass range in the lower forest area. (Courtesy of U. S. Department of Agriculture.)

mountains, where temperatures of −20 and −30 degrees are known, winters are mild.

The length of the growing season is also related to altitude and proximity to high mountains. In the southern part of the state, the frost-free period is over 200 days and may be as long as 273 days; while in high mountain valleys of the north the growing season ranges from 40 to 115 days, with an average of less than 90. In the high altitudes frost may occur every month in the year. Under such conditions only the hardiest vegetables and grasses can survive.

Average annual precipitation varies widely over the state. Lowland areas in the south may average less than ten inches, while the mountain peaks of the north receive more than 30 inches annually. Increased elevation is generally reflected in increased precipitation, but many sheltered locations at high altitudes receive less precipitation than more exposed ones of lesser elevation. Away from the mountainous areas, the greatest precipitation occurs on the high plains of the eastern part of the state. Due to the rugged broken character of the topography of a large part of New Mexico, abrupt changes in altitude account for sudden changes in precipitation over very short distances. Rainfall is seasonal, over 60 per cent coming in the months of April to September. Distribution of rainfall is more favorable in the east where there is a gradual increase from April to July and a decrease toward the autumn. West of the Rio Grande a large percentage of the annual precipitation is concentrated in the months of July, August, and September. In all of the mountain areas there is precipitation throughout the year.

Snow falls throughout the state, but only on the high plateaus and mountains does it remain long on the ground. The lower Rio Grande Valley has an average annual fall of less than ten inches; high plateaus and mountain slopes at elevations of from 7,000 to 9,000 feet receive 30 to 80 inches; but, as would be expected, the greatest snowfall occurs on the high mountains of the north where as much as 300 inches has been noted.

NATURAL VEGETATION

The natural vegetation of New Mexico consists of a great variety of types, ranging from the arctic sedges, weeds, and grasses of the alpine peaks, to the semi-desert grasses and shrubs of the low, dry regions. This variety is due to the differences in elevation, rainfall, temperature, soil, and length of growing

season prevailing in different sections. The area of alpine pasture is too small to be of any great significance. The most important vegetative types from the standpoint of the cattle industry are: forest, woodland, semi-desert grass and shrub, oak shrub, and short grass.

Forests occupy the mountain slopes at elevations of from 7,500 to 10,000 feet. Western yellow pine (*Pinus ponderosa*) is characteristic of the lower part of the forests. At 9,000 feet the pines give way to Douglas fir (*Pseudotsuga taxifolia*), white fir (*Abies concolor*), and quaking aspen (*Populus tremuloides*) which extend almost to timberline, in most places about 10,500 feet. Near timberline, the Engelmann spruce (*Picea engelmann*) becomes the dominant forest tree.

Valuable grazing lands are generally confined to the lower forest regions where blue grama (*Bouteloua gracilis*) is commonly found. Above this grow pine grass (*Festuca arizonica*), mountain muhly (*Muhlenbergia montana*), and beardless pine grass (*Blepharaneuron tricholepsis*). Interspersed with the grasses and trees are numerous species of weeds and brush, useful as browse. The carrying capacity of forest land is generally low, about one animal per 90 acres, and its use is restricted to summer and early fall.

Woodlands, chiefly of juniper (*Juniperus spp.*), pinon (*Pinus edulis*), and occasional oaks such as *Quercus arizonica*, occupy elevations of from 5,000 to 7,000 feet, and are useful for year-round grazing. Common forage types are: blue grama, galleta grass (*Hilaria jamesii*), Texas timothy (*Lycurus phleoides*), side oats grama (*Bouteloua curtipendula*), black grama (*Beriopoda*), and various species of *Muhlenbergia*. There are in addition browse types such as saltbush (*Atriplex spp.*), beargrass (*Nolina microcarpa*), and willows

FIGURE 4.—A semi-desert type of range such as is characteristic in southern New Mexico. Black grama and soapweed. (Courtesy of U. S. Soil Conservation.)

(*Salices*). Woodland regions ordinarily support one cow per 70 acres on a year-round basis.

The area covered by oak shrub is located in the southeastern part of the state. Vegetation is characterized by a low growth of shinnery oak (*Quercus harvardii*) and a number of species of tall grass, such as *Andropogon* and *Aristida*, as well as soapweed (*Yucca glauca*), sage (*Artemisia spp.*), and numerous weeds. The carrying capacity of this land is somewhat less than the woodland areas.

Semi-desert vegetation occurs on the lower plains, mesas, and valleys of the northwestern, southwestern, and southern portions of the state. In the Rio Grande and San Juan valleys grasses

FIGURE 5.—Semi-desert grassland in bloom. (Courtesy of U. S. Department of Agriculture.)

predominate, but elsewhere shrubs are more common. Characteristic species are: creosote bush (*Covillea tridentata*), blackbrush (*Flourensia cernua*), mesquite (*Prosopsis glandulosa*), soapweed (*Yucca spp.*), chamiso (*Atriplex spp.*), and others. Grasses which are commonly found on the high mesas and plains include black grama, dropseeds (*Sporobolus spp.*), and bush muhly (*M. porteri*). Sacaton (*Sporobolus airoides*), tobosa grass (*Hilaria mutica*), and burro grass (*Scleropogon brevifolius*), occur in lower, poorly drained or alkaline regions. The value of semi-desert lands for grazing depends largely upon the type of vegetation. Over much of the area covered with brush, carrying capacity is about one cow per 150 acres, excepting where there are large amounts of chamiso, in which case the capacity is considerably increased. The carrying capacity of the semi-desert grasslands is much greater, and under favorable circumstances, one cow can be supported on from 50 to 80 acres.

By far the largest amount of grazing land in New Mexico is contained in the short grass region which lies east of the mountains on the great plains. Here, blue grama is the most common forage plant. In the eastern part of the state buffalo grass (*Buchloe dactyloides*) is also common, while elsewhere black grama, hairy grama (*B. hirsuta*), side-oats grama (*B. curtipendula*), red three awn (*Aristida longiseta*), and various muhlys and yuccas are found. In regions which have suffered from long overgrazing, snakeweed (*Guiterreza sp.*) covers large areas, making them unfit for grazing. In the east some sandy soils support a growth of tall grasses, chiefly big bluestem (*Andropogon furcatus*), little bluestem (*A. scoparius*), and three awns (*Aristida spp.*). It has been suggested that tall grass covered even larger areas but has been destroyed by fire, overgrazing, and plowing. Certainly, explorers, searching for railroad routes across the state before the Civil War, mention the great expanse of tall grass. The short grass region has the greatest carrying capacity of any of the grazing regions of the state. Here one cow can be supported on from 20 to 60 acres, with an average figure for the whole region of 45 acres per cow.

SOILS

The differences in climate, rainfall slope, and age of parent material, cause

the soils of New Mexico to vary widely from one section to another. Throughout a large part of the state, particularly in the mountain and foothill region, soils are thin and immature; in mountain valleys, where they are being added to by constant alluviation, deep loams are found. On the lower slopes of mountains, and on alluvial fans, soils are gravelly and stony and low in water holding capacity. All of these soils have poorly developed profiles, because of the youth of the parent materials. In the principal river valleys, sand and gravel, as well as deep loams are found, but despite the fact that climate and vegetation favor its development, a zone of carbonate accumulation is seldom found because of annual additions of new parent material. Throughout most of the state, the geology of the parent material is more important than the soil forming processes. Many low or poorly drained areas show a white coating on the surface, a sure indication of a saline or alkaline soil.

A large part of New Mexico is occupied by mesas, plateaus, and high plains. Over these, soils may vary from sand and gravel to adobe clay. In most of these, the zone of carbonate accumulation is very well marked, and the caliche, so-called, may attain a thickness of several feet below the thin layer of top soil. In places where the upper horizon has been completely eroded, caliche appears at the surface.

FACTORS OF IMPORTANCE TO THE CATTLE INDUSTRY

The land use of New Mexico has been determined by both geographic and economic factors. Historically, the cattle industry has been one of the frontier. From the limestone valleys of Pennsylvania in colonial times, to the prairie lands of the Mississippi Valley, and finally to the far west, cattle have been pushed by the demand for agricultural land. Only that land is available for grazing which, for various reasons, is undesirable for cropping. In New Mexico, large areas of level land are of little agricultural importance because of lack of sufficient water, and so are devoted to grazing; likewise, there are other areas, chiefly along the mountain borders, where rainfall is adequate for crop production, but where the land is too rugged and rocky, or the growing season too short for profitable agriculture. The highland areas are used principally as summer pasture for stock.

FIGURE 6.—Undersized three year old steers of poor conformation. (Courtesy of U. S. Department of Agriculture.)

Over the greater part of the state, rainfall is too scanty, and too variable in distribution throughout the year, to allow profitable farming without irrigation, even where soils are suitable. Much of the cultivated land in the dry farming regions is too shallow, too coarse or too tight in texture to permit cultivation without being irrigated. Nevertheless, such land will support an excellent stand of natural forage for grazing.

Short grasses predominate. They are shallow rooted, nutritious, and make their greatest growth during summer, the rainy season. Their value as forage is enhanced by the fact that they cure on the stock, retaining much of their nutritive value. These grasses may be grazed during fall and winter,

except when the ground is deeply covered with snow. In the semi-desert areas, shrub-steppe formations are common, and furnish valuable forage.

The extreme dryness of a large part of the state may be unfavorable for grazing because of a lack of feed in bad years, but in a sense it is an advantage because the numerous diseases and pests common to warm humid climates are almost entirely absent in these dry lands. The average loss from disease among the cattle of New Mexico amounts to only about one per cent of the total losses.

The location of New Mexico is a definite advantage to the livestock industry. Its position is almost equidistant from a number of important markets to which stock can be shipped at reasonable rates. Major rail lines connect the cattle districts of the state with these markets, and a system of state highways makes long drives to shipping centers unnecessary, since animals can be trucked to loading points or to feed lots.

The state is sparsely populated, and in consequence, the local market for many agricultural products is extremely limited. Surplus products would have to be shipped long distances to the densely populated consuming centers, in which case cost of transportation amounts to more than the value of the products. For this reason the state has turned to the production of those materials and goods which have a high value per unit of weight. Among the most important of these are: beans, wheat, alfalfa seed, cotton, wool, sheep, and cattle. Natural conditions favor the raising of livestock, so that has become the major agricultural industry.

DISTRIBUTION OF GRAZING LANDS

The relative importance of the grazing industry can be seen from the following figures. Of approximately 78 million acres of land in the state, 30 million acres, or about 39 per cent is in farms and ranches. Of this land, approximately 92 per cent is used for grazing, 6 per cent for crops, and 2 per cent is waste land. Land not privately owned, consisting principally of national forest, 10 million acres; public domain, 16 million acres; Indian land, 2.4 million acres; and railroad land, 3 million acres, is used to greater or lesser extent for grazing purposes.

Private land holdings are scattered throughout the state, but are of greatest importance in the east. State lands are largely concentrated in the southern and western portions of the state, while the largest areas of public domain are located in the west. National forests generally occupy the higher mountain regions. Numerous small Indian holdings are found in or near the Rio Grande Valley, but the greatest amount of Indian land is in the western and northwestern portions of the state. Railroad lands are chiefly in the west, along the right of way of the Santa Fe.

The size of units devoted to cattle raising varies in different parts of the state, ranging from a section or even less, where cattle are raised in conjunction with crops, to as much as a half million acres in the larger cattle ranches. In parts of the state Spanish grants still remain almost intact. In general, the amount of land necessary to insure profitable operation of a cattle business is determined by the amount of forage available. In the west and south, units devoted to cattle raising are usually larger than in the east where grass is better.

In "A Preliminary Study of 127 New Mexico Ranches in 1925" (Bulletin 159, Agricultural Experiment Station of the New Mexico College of Agriculture and Mechanic Arts. January 1927), Walker

and Lantow divide the state into three sections or districts. The first of these, located in the eastern and northeastern portion of the state, although smaller than either of the other two, contains a larger number of cattle because heavier rainfall results in better grass cover. This is also the important agricultural section of the state, and wheat and row crops are important. The southern and central counties comprise the second district. Rainfall is less than in the east, and agriculture is almost entirely confined to irrigated bottom lands. There are large areas of rough and mountainous land which are suitable for cattle. The third district includes most of the remainder of the state except the north-central and northwestern counties where sheep are of greater importance than cattle. On the western border of the state rainfall is low, excepting in the highlands, and the topography is rugged to mountainous. Agriculture is of minor importance. In area, this is the largest cattle district in the state, but the number of animals is less than in the east.

Farms and ranches in New Mexico vary greatly in size, but cattle are a source of revenue on most of them. In size, they range from small holdings which feed a few cattle to great ranches occupying large parts of whole counties, which number their stock by the thousand head. The most widely distributed type is the combination crop and livestock farm which derives only a portion of its income from cattle. These farms are widely scattered throughout the state because of the large area suitable for grazing. Small units can be most profitably operated in the east where there is an abundance of good grass and where supplementary feed can be raised. Some of the largest ranches in the state are also located in the eastern section, but smaller holdings are relatively more important.

In this region, a large proportion of the land is owned by ranch operators. Most of the land not so owned is leased from private individuals as there is little state land or public domain here. The average size of the holdings devoted entirely to cattle raising is about 35 sections.

In the southern part of the state, rainfall is lower, grass cover is sparse,

FIGURE 7.—A white face calf, product of a Hereford bull. New Mexico cattle have been improved until almost all of the herds in the state are Herefords. (Courtesy of U. S. Department of Agriculture.)

and agriculture is impossible except in irrigated regions. Hence, outside of the river valleys, small ranches cannot profitably be operated. There is more state land and public domain in this area, most of which is absolutely unfit for crop production. The average cattle ranch, which here contains about 75 sections, consists largely of public domain, land leased from the state, the railroads, or the forest service.

In the western part of the state, where rainfall scarcely exceeds 12 inches, vegetation is scanty, and there are vast areas of rugged and rocky land. Little of this land is suitable for agriculture, so it is almost entirely devoted to grazing.

There is much public land in this region, and ranches consist chiefly of public domain and leased lands, with only a small fraction of the holdings owned by the operator. In contrast to the 34 sections in the eastern part of the state, the average ranch here contains 85 sections.

BREEDS OF CATTLE

Although cattle and cattle products were of great importance to the Spanish settlers, there had been no effort to improve breeds before 1850. At that time, four different breeds of cattle are said to have been grown in Texas and New Mexico. All were thin, long legged, long horned, and wild. While admirably adapted to care for themselves on plain and mountain, these animals could be fattened only with great difficulty. As a beef producer, the famed Texas longhorn was of little value. With an increasing demand for better meat, efforts were made to raise an animal which would grow to a larger size, fatten more readily, and thus give greater profits for the feed consumed.

Blooded Hereford bulls were introduced and crossed with native cows. The resulting animals were far more profitable to raise than the longhorns had been. Through the years, more Hereford blood has been introduced, until today practically all of the cattle in the state are of this variety. In general, the best cattle are found on the eastern plains. In the south and west, there are occasional animals which show some of the characteristics of the Spanish cattle. Such animals are found there because of the close proximity to Mexico, and the occasional practice of building up of herds from cheap Mexican cows. The true longhorn is practically extinct, except for a few which may be imported in an attempt to fatten them.

RANGE MANAGEMENT

The six-gun cowboy has long since left the range and many changes have taken place since the golden age of the cattleman. Ranges have been fenced, cattle and the methods of handling them have been improved, wells have been drilled; but the raising of beef cattle continues to be the major agricultural industry of New Mexico.

Like the rest of southwestern United States, New Mexico is especially adapted to production of young range cattle. There are certain natural factors which determine the age at which animals can profitably be shipped. Among the most important of these are difficulty of supplying good spring grazing, and an adequate amount of water at all times. There is usually a shortage of fodder for fattening purposes. In order to fatten well, animals must be kept under continuously good conditions, and the recurring droughts in New Mexico make this all but impossible, except in a few places. It is said that many New Mexico fattened cattle show the effects of one or more seasons of drought.

Since it is difficult to raise a high grade of slaughter animal to maturity on the range, most of the cattle are disposed of as calves and yearlings. Only in isolated regions, where the drive to a shipping point would be so hard as to cause a heavy loss among the calves, are two year olds commonly sold. Because most of the young animals have been disposed of, there is a high percentage of breeding stock left on the range. Large numbers of cows in comparison to the number of younger animals is characteristic of most ranches in New Mexico.

The climate of New Mexico is generally so mild that it is not necessary to feed and shelter animals even during

the most severe winter weather, consequently the cost of production is lower than in regions where winter feeding is essential. Year long grazing is the rule.

The problem of getting sufficient feed for the breeding herd may become acute during abnormal years of drought, even though the younger animals have been sold. If no provision has been made for winter feeding, which is frequently the case, death losses from starvation may be very high On poor ranges, losses of

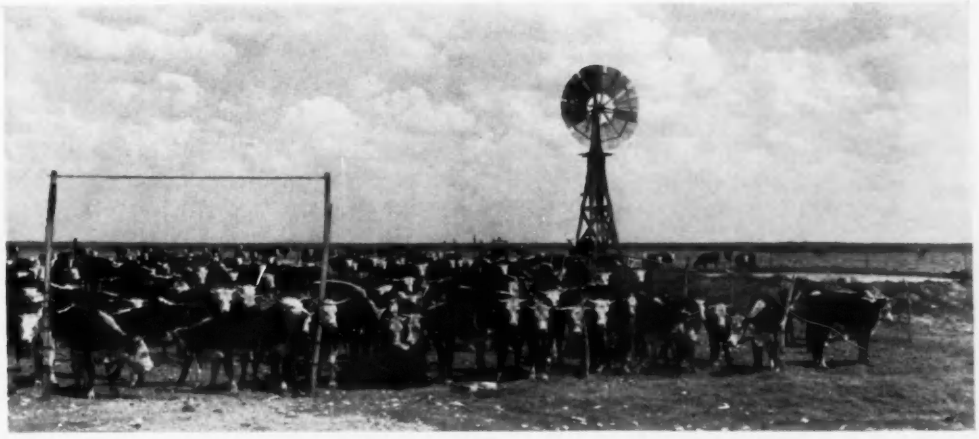


FIGURE 8.—Livestock industry still plays a major part in the economic life of New Mexico. Cattle gathered around a water hole is a familiar scene throughout the state. This group of Herefords was photographed in eastern New Mexico near Lovington. (Courtesy of New Mexico State Tourist Bureau.)

from 20 to 50 per cent have been known, but the average loss for the state is about 12 per cent. Losses are least in the eastern part of the state where ranges are better and food is available for supplementary feeding. In this section conditions are favorable for crop production, and many of the smaller ranches regularly supply some winter feed for cattle.

Generally, cattle are left on the same range throughout the year; this practice being particularly common in the southern part of the state. Heavy year-round grazing often results in a relative increase in the numbers of unpalatable plants because the palatable ones have had no opportunity to reseed. There has been a tendency in some places to reserve certain sections for winter and spring grazing. This is particularly true where ranches include mountainous areas which are used for summer grazing, while the lowlands are used in winter and spring when snow and low temperatures make the highlands unavailable. Another advantage of using mountain and forest land in conjunction with plains is that these different types of ranges seldom suffer from drought at the same time.

Ranches located entirely in the mountains, or at high altitudes where the weather is extremely cold and snow cover deep, may find it almost impossible to have year long grazing. Unless there are sheltered places, where feed can be provided, death losses may be high during severe winters.

Even though year long grazing is the principle upon which the cattle industry of New Mexico is based, there are times when winter feeding is necessary in order to carry animals through particularly severe weather. Such supple-

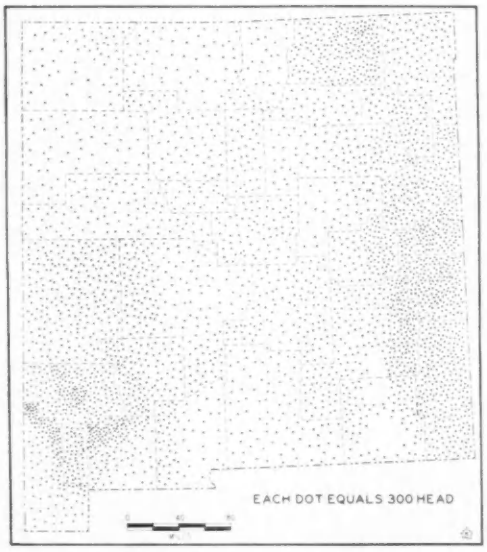


FIGURE 9.—Cattle in New Mexico. Included are approximately 72,000 dairy cattle concentrated near the cities. (From U. S. Census of Agriculture 1935.)

mentary feeding is commoner in the dry farming areas or in the vicinity of irrigated valleys where feed can be obtained at a reasonable cost. Smaller combination crop and stock farms may raise some feed, but the larger stock ranches raise few crops. Some hay is raised on the ranches of the northeastern part of the state, chiefly for saddle horses and the weaker cows.

The problem confronting cattlemen is whether it is more economical to have large feed bills or to lose a few of the weaker cows. Extensive winter feeding is usually confined to those areas in or near the better agricultural regions, for in isolated districts, rough or mountainous country, the cost of transporting the necessary feed is so great that it may be cheaper to let weaker animals die. Even where winter feeding is the usual procedure, it is confined to weaker animals and is supplementary to their regular grazing. About a pound of cottonseed cake is fed daily from December until the time that forage is available in the spring.

In addition to scarcity of feed at certain times, there is the problem of obtaining a sufficient amount of water for cattle in semi-arid regions such as New Mexico. On many ranches large amounts of money have been invested in the drilling of wells and the construction of tanks and ponds to insure an adequate supply of potable water. On private lands adequate provision for watering cattle has generally been made, but on the public domain or free land an entirely different situation has obtained since men hesitate to go to the expense of making improvements on land over which they had no control.

From the beginning, the public domain had been considered the property of the man who could hold and use the land. The result was that vast areas became overstocked both winter and summer, and the range steadily deteriorated. With no permanency of tenure, there was no disposition on the part of the users to invest large sums of money in wells, tanks, and other improvements. Under the provisions of the Taylor Grazing Act, such land is now under control and is allotted to permanent users. This act allows permanent control and planned use of the range, with the resulting assurance that the user will receive the benefit of improvements which he may make on the land.

Although the so-called cow ranches, where young animals are sold and breeding stock retained, are the most important type in New Mexico, in a few places, steers alone are carried. In the eastern and northeastern parts of the state steers are fed on many small ranches. This type of ranching is confined to the eastern part of the state because of a number of advantages of location, climate, and topography. East of the mountains there are large areas covered with grama and buffalo grass which furnish excellent grazing. The

climate of the plains region is generally mild, and year-round grazing can be conducted; during the most severe winter weather, the breaks or small canyons cut in the tableland furnish shelter for animals.

This part of the state is close to the Panhandle of Texas, the important steer center of the United States, and is also so situated that supplies of steers can readily be received from other sections of New Mexico. Steers fed in this section of the state are in close proximity to the important markets for feeder cattle in Colorado, Kansas, and Missouri.

FEEDING CATTLE FOR MARKET

Although most of the cattle shipped from New Mexico are sent to feed lots elsewhere, there is a growing disposition to fatten more cattle at home. This is particularly true in the eastern and southern parts of the state where feed is available. The irrigated sections, principally in the Pecos Valley, produce large quantities of alfalfa hay, silage, sorghums, and cottonseed meal, which can be fed to cattle raised on ranches bordering the valley. In this region, the number of cattle fattened has increased over four-fold in recent years, from about 8,000 head in 1936 to an estimated 35,000 head in 1939–40. In the dry land farming areas, feeding is concentrated about the city of Clovis, where row crops such as saccharine and non-saccharine sorghums, milo, and Kafir corn furnish suitable feed when supplemented by small amounts of cottonseed cake.

The local fattening of cattle came about as a result of difficulty in marketing surplus roughage. The demand for such agricultural products as alfalfa hay declined with the decreasing numbers of horses and mules in the south and southwest; furthermore, the cost of shipping bulky products to distant markets is so great that little profit remains. Such low grade roughage can most profitably be disposed of by feeding to stock.

Farmers can get a monetary return from their surplus roughage only by converting it into edible meats. Experiments have shown that about a half ton of alfalfa together with a smaller amount of other feed to balance the ration will produce a gain of approximately 220 pounds per animal. Since freight rates from points in New Mexico to Kansas City are about the same for both hay and slaughter cattle, the farmer gains by shipping the more valuable product to market.

In the Pecos Valley, the average net return to farmers feeding cattle has been from $7.00 to $10.00 per head, although there is a wide variation in individual cases. Such New Mexico fed cattle are comparable in quality to slaughter cattle from other feeding sections, for from 50 to 60 per cent of them have dressed out carcasses grading choice at the Kansas City market.

MARKETS

Cattle from New Mexico move to market at the rate of more than a half million annually. The principal destinations are: Colorado, Kansas-Missouri, Texas, and California. The Kansas-Missouri market takes slaughter cattle from the irrigated and dry farming districts as well as cattle for the feed lots and grass pastures of eastern Kansas and western Missouri. Likewise, the packing houses and feed lots of Colorado take large numbers of animals annually. Texas takes both feeders and fat cattle. The California market is more distant from New Mexico and Arizona cattle enjoy lower freight rates, but because of the attempt

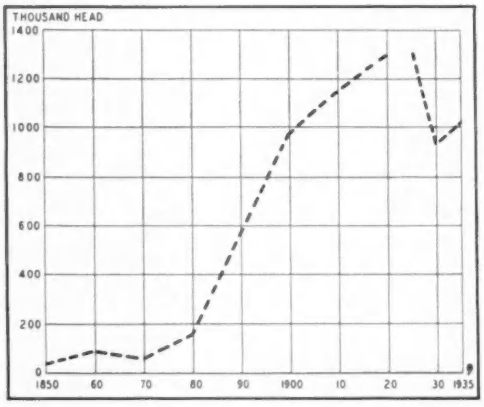


FIGURE 10.—Cattle in New Mexico, 1850 to 1935.

to maintain a continuous controlled supply of meat, this market is expanding somewhat.

There is also a considerable local market for both fat cattle and feeders. Stockyards in the Pecos Valley and in Albuquerque purchase animals from their immediate vicinity as well as from the eastern part of the state. These local markets, while limited in extent, are increasing in importance.

Markets for New Mexico livestock destined for feeder lots in the corn belt may be improved by a new ruling which allows a through rate from the point of origin to Chicago for all such animals whether or not they have been unloaded and sold en route. While this change of ownership privilege will be a direct benefit only to the buyer, it may react to the advantage of the seller, since it should result in more buyers coming west for feeder stock.

CONCLUSION

Factors which might tend to cause an increase in the number of cattle in New Mexico are balanced by others which would retard such an increase. Throughout the state, but especially in the eastern part, there are large areas of land which have been devoted to the production of wheat, beans, or other crops. Following years of high production, such land has increased in value, and croplands have been extended. Years of drought and sandstorms have demonstrated that much of such land should never have been plowed, for once the original herbage has been removed, it is only with difficulty that it can be restored. Much good pastureland has been destroyed in this manner.

In sections now devoted entirely to cattle production, there has been much overgrazing in the past, with consequent reduction in the carrying capacity of the land. It will be some time before these lands can be built up to a point where they will furnish adequate forage for numbers of animals.

The principal factor tending to increase the number of cattle is the growing realization among farmers, particularly those in or near irrigated districts, that surplus roughage can most profitably be sold as beef rather than as hay or fodder, in some distant market.

At the present time many ranges are stocked only to their capacity under unfavorable conditions which means that at almost all times there is sufficiency of forage. In this way there is less danger of overgrazing and soil erosion, and a greater assurance that losses from starvation will decrease. During the past few years the emphasis has been on quality of animals rather than number raised. It is improbable that the number of cattle in the state will increase appreciably in the near future.

LAND OWNERSHIP IN MIDDLE PARK, COLORADO

Charles M. Davis

MIDDLE PARK is one of four basins formed by the festoon arrangement of the Rocky Mountain ranges in Colorado. Each of these basins contains a somewhat different combination of water for irrigation and flat land for cultivation. These basins, or parks to give them their local name, are the only areas between the plains to the east and the plateau country to the west which contain any important and continuous populations and any considerable proportion of privately-owned land (Figure 1).

These parks had their settlement beginnings in the days of the expansion of cattle ranching throughout the western grasslands and the form and characteristics of the land ownership patterns in them are traceable to these beginnings. In Middle Park and in North Park the climatic restrictions on agriculture are so severe that the economy has remained focused on ranching and the land pattern is still adapted to that end. In contrast the two southern basins, South Park and the San Luis valley, have developed crop agriculture and in them the ownership patterns have acquired finer textures which largely obscure the original designs.

Setting of Middle Park

Middle Park was the least favorable of any of these mountain areas for cattle ranching and at the time of settlement was certainly the most isolated. The basin surface in contrast to that of North Park is rough and broken. The part lying south of the Colorado River is traversed by two mountain ranges and the northern half is crowded with high volcanic buttes and steep-sided mesas. The river and its tributaries have cut narrow canyons through this surface and there are few places where these are wide enough to support the extensive meadows necessary to mountain cattle ranching.

On either side of the river the buttes and mesas stretch back to the mountain foothills and are covered with a thin but useful growth of sagebrush and grass which years of overgrazing have reduced to the condition illustrated in Figure 2. The timbered slopes contain many open vales which supplement the grasses of the mesas and the meadows. On all sides the Park is surrounded by mountain walls. The alpine summits of the Colorado Front Range form an effective barrier on the east, traversed by only a few practical passes from the plains side. The Park Range on the west is somewhat less high but is equally rugged. This is breached by the narrow gorge of the Colorado River. Early access by cattlemen and their herds came from the Wyoming Basin through North Park.

Land Ownership Periods

The present aspect of the pattern of land ownership in Middle Park (Figure 3) is the result of various cultural forces which have exerted influence during the fifty-five years of occupation. For the sake of clarity it is convenient to think of these forces in four distinct periods. During the first of these, from 1860 until 1890, the Park was opened to settlement and the early ranchers came in. The second period, from 1890 until 1910, was characterized by the growth

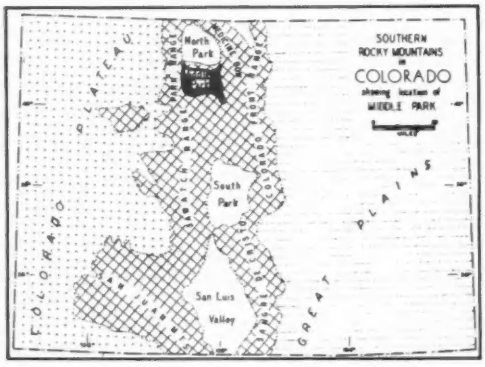


FIGURE 1.—Middle Park is completely enclosed by the Rocky Mountain ranges. The principal settlement came in from the north through the Wyoming Basin.

of ranching on the style of the open range. As a result of the enlarged homestead laws, the third period, from 1910 until 1925, was one of change and confusion. Much of the upland range passed from public to private ownership through the process of homesteading. The recent decade, from 1925 to 1935, has been marked by the absorption of this homestead land into the ranch ownership.

EARLY YEARS (1860–1890)

In the closing years of the decade of 1850 one of the principal axes of the mining activity along the Rocky Mountain Front Range extended up Clear Creek canyon behind Denver and through the camps of Idaho Springs and Georgetown. The headwaters of Clear Creek are separated from the Frazer River tributary of the Colorado in Middle Park by a sag in the continental divide called Berthoud Pass. Over this pass extended the trail and later the wagon road which connected the Denver mining district with the settlements of the Salt Lake Basin. Berthoud was not an easy pass but it was no obstacle to the highly mobile prospectors who, from the mines almost at timberline on the eastern slope, spilled over into Middle Park. In the 70's a mild mining boom was in progress in the Park and a few small towns had grown up along the River. A wagon road had been constructed over Berthoud Pass to supply this settlement.

By 1880 the mining had passed its peak. There were about four hundred people in the Park according to the census of that year, more than half of these residing in the little towns along the river. The ore deposits were neither rich nor extensive enough to justify local smelters and the cost of transporting ore over the pass was prohibitive. The mining boom faded rapidly and made no permanent impression on the future pattern of land ownership except to establish the towns. It had, however, brought to the attention of the cattlemen operating on the plains east of the mountains the "abundance of good grass in the lower valleys and along the Grand (Colorado) River in summer where cattle will not only live but grow fat upon it."

The western cattle economy, developed on the plains of Texas, spread northward on the belt of steppe grasslands along the Rocky Mountain front. The essentials of this business were cheap, preferably free, grass-covered land and a railroad to the eastern markets. The distance which cattle must be driven was not significant provided there was pasturage along the way and rapid transportation at the end of the drive. The combination of unoccupied steppe country and transcontinental railroads in the late 60's and early 70's permitted the colorful but ephemeral "cow country" to develop on the plains. The tremendous expansion of the cattle business supported by strong markets and large capital investments led to the depletion of the plains grasses and a scramble for new grazing lands. No matter how remote and inaccessible

an area might be in terms of ordinary commercial transportation, it was suitable for the cattlemen if it was connected to a railroad by a driveway of forage grasses. In 1868 the Union Pacific crossed the low swell in the Wyoming Basin which separates the Atlantic and the Pacific watersheds. A decade later the cattlemen were pushing into the mountain basins of northwestern Colorado.

From this railroad the trails followed up the valley of the Platte River or over the low mountains of the Medicine Bow Range and into North Park. The settlement and development of the land pattern of this basin has been described in an earlier article in ECONOMIC GEOGRAPHY. It was easy to drive cattle from North Park into Middle Park over Muddy Pass, less than a thousand feet above the park floors and barely reaching to the zone of foothill forests. For a few years this driveway must have been used in taking the cattle over for summer grazing and bringing them back in the fall. The census returns of 1880 indicate that there were no permanent ranching establishments and stock had been "wintered" in the Park for the first time in 1879. By 1890, however, the open range system was well developed with more than one hundred ranches, seventy-five hundred cattle, and eight thousand acres of irrigated meadow land.

FIGURE 2.—Sagebrush mesa upland in the northern part of Middle Park. This is the type of land which the ranchers used but did not find valuable enough to acquire.

OPEN RANGE PERIOD (1890–1910)

The ranching system which grew up in Middle Park was different from that of the plains grasslands because of the nature of the forage resources. The only natural winter pastures were the small meadows along the stream bottoms where cattle might find some shelter and be maintained by the natural hay (Figure 3). In Middle Park, as in North Park, these were the key spots and those which the ranchers first acquired. Their enlargement and improvement by irrigation into hay fields for the production of winter forage progressed rapidly through the open range period. In the discontinuous and small level spots along the streams no expensive dams were necessary and few lateral ditches needed to be constructed (Figure 4). By 1890 approximately one-fourth of the bottom land had come under irrigation. This meadow land was "private" land; all the remainder

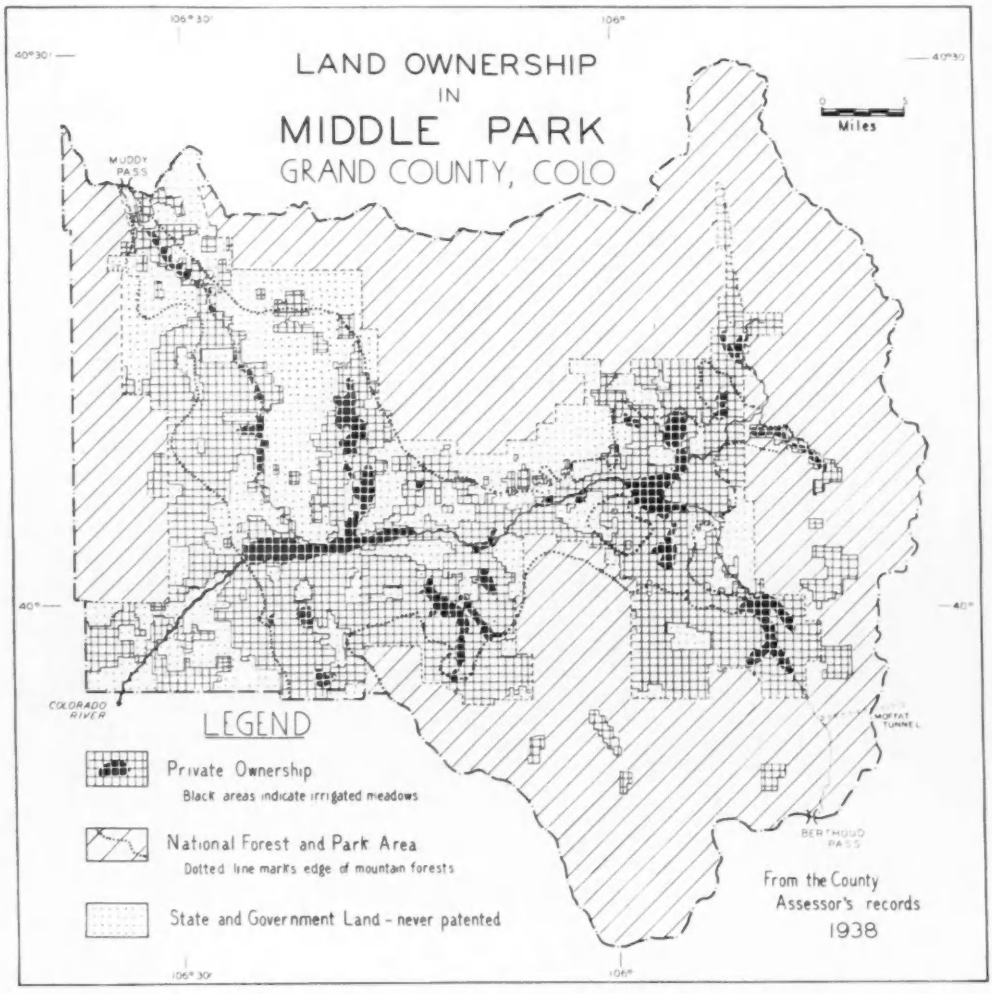


FIGURE 3.—The relationship of land ownership to land type. The irrigated meadows along the streams were the first type of land to go into private ownership. The state and government ownership is composed mostly of sagebrush mesa land which has not been worth private ownership.

of the Park, sagebrush and mountain slopes, was open range. A rancher could "run" as many cattle as he could feed through the winter on the produce of his meadows. Until the peak of homesteading there was no shortage of summer pasturage and the number of cattle in the Park increased in general proportion to the increase in the amount of meadow land (Figures 6 and 7).

Land acquisition in Middle Park followed in general the model established by the cattlemen on the plains. The home ranch did not include much acreage but by containing the key resource, in this case winter forage land, it effectively controlled the range. The ranchers acquired the irrigable lowland by homesteading and purchase but their herds were by no means confined to the meadows. The great extent of the public domain was used by anyone who controlled the complementary necessity of winter forage. The grass of the public lands nourished private cows and in time the cattlemen came to

regard this not as a privilege but as a right. In the brief but strenuous history of the western range, many a cowboy and many a sheep herder died in sanguinary argument as to who held this right to reap the harvest of the public lands.

During the open range period there was neither necessity nor inclination to acquire the sagebrush uplands and the mountain foothills. These the ranchers used without owning. The increase in the amount of private land from 1890 the ranchers actually owned about fifteen per cent of the land they used in their operations. Whatever were the traditions and gentlemen's agreements during the first thirty years of ranching in Middle Park, they were sufficient to preserve for the cattlemen the use of the upland pasture without the necessity of acquiring very much of it.

During the open range period the mountains were considered part of the public domain, to be used when possible but not ordinarily worth owning. The

FIGURE 4.—An irrigated meadow along the Colorado River. The photograph shows the edge of the forested foothill land. Taken in September after the hay had been cut and stacked and cattle were grazing on the stubble.

until 1910 (Figure 6) is composed almost entirely of irrigated rather than dry acreage. A certain amount of dry grazing land had gone into private ownership along with the meadows but there was no desire to pay taxes on land which could be used without being owned. The census statistics indicate that in 1910, the end of the open range period, there were about twelve thousand range cattle in the Park and only about seventy-five thousand acres of grazing land owned by the ranchers. Upon the present carrying capacity of the ranges and allowing for the serious depletion which has resulted from overgrazing, it seems fair to estimate that higher and more densely wooded slopes never have been good cattle range and the lower foothills were not used intensively until the increase in hay from irrigated meadows permitted a larger cattle population. About 1900 most of the mountain land was taken into the National Forest ownership without much opposition from the ranchers. There was no intention on the part of the government to include in the forests any considerable amount of land which had potential use for grazing. Where valuable grassland was included, the Forest Service was almost always willing to make adjustments in favor of the cattlemen and until the forest ranges

were mapped and classified their carrying capacities were estimated by the Service in a most liberal fashion.

The method of land acquisition during this period was homesteading or purchasing the 160-acre unit. The Homestead Act of 1862, allowing the preemption of 160 acres, was designed for humid farming and was not at all suited for the conditions of semi-arid grazing. It was, however, the only means available other than purchase for obtaining land. Some of the homesteading in the Park, like that elsewhere on the ranges, must have been carried out for the specific purpose of adding to existing holdings rather than establishing new ones. At the close of the open range period approximately half of the ranches (Figure 5) were of the 160-acre size, but these contained only one-fourth of the owned land in the Park. The remaining three-fourths was comprised of ranches which had become larger by the addition of one or more quarter-sections to the original tract.

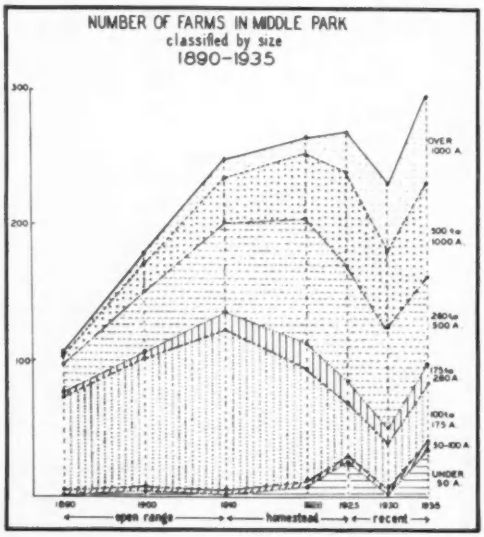


FIGURE 5.—Throughout the open range period the 160-acre holding was the basic type. This declined in importance after the passage of the Enlarged and Stock-raising Homestead Acts. The development of small holdings in the last fifteen years has resulted from truck farming and recreational business.

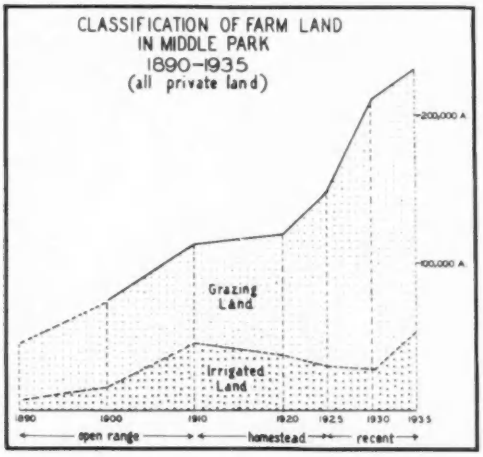


FIGURE 6.—During the early period there was little emphasis on the acquisition of the dry grazing land. Since the homestead period the ranchers have been forced to buy this type in order to use it.

Figure 6 indicates that the additions to the privately owned land during the period of the open range were almost entirely composed of irrigated or irrigable land. The upward trend of the total amount of private ownership from 1900 until 1910 is a resultant of the amount of irrigated rather than of dry grazing land. The explanation can be found in the practice of using the dry land without owning it.

In spite of the increasing land ownership through the period from 1900 to 1910 there was a relatively small increase in the number of range cattle (Figure 7). There must have been a fairly close adjustment between the available forage and the amount of stock. The carrying capacity of the Park today is estimated by the Forest Service to be around twelve thousand animals and the stockmen seem to have arrived at about the same figure by whatever rules of thumb they used. It is interesting to note from the same figures the relatively small number of

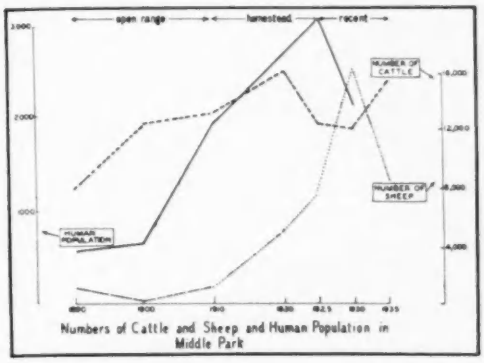


FIGURE 7.—Until 1910 there seemed to be an optimum number of cattle, about twelve thousand on the Park ranges. The homestead period increased this number and added sheep to overstock the range. Since 1925 the numbers of sheep and cattle vary with markets and in inverse ratio with each other.

sheep on the ranges during the early years. In view of the changes in the animal population during the homestead period this might be interpreted as an indication of how completely the cattlemen controlled the public grazing land.

From 1900 to 1910 the human population more than doubled itself, but this probably is not explainable in terms of ranching. In this period the railroad arrived in the Park. For years it had been the enthusiastic hope of persons on both the eastern and western slopes of Colorado to build a direct line from Denver to Salt Lake and early in the century it was begun. With innumerable trestles, tunnels, and hairpin switchbacks the new railroad wound a tortuous way to the crest of the Continental Divide at Rollins Pass and rolled down to the Frazer River. It crossed the Park and followed the canyon of the Colorado through the mountains and out to Craig on the plateau. Having overcome the obstacles of nature the progress was stopped when it had reached about half way to Salt Lake by financial difficulties. The new lands and coal mines of western Colorado were supposed to furnish revenue but, somehow, these were never sufficient to make the railroad pay. Construction costs had been very high because of the nature of the land surface and it took powerful snow-fighting equipment and about forty per cent of the operating costs to keep Rollins Pass clear in winter. The railroad provided direct access to the Park and ended the cattle drives across Muddy Pass. It brought new populations to the towns: tourists, hunters, and fishermen; in the next decade it brought the homesteaders.

HOMESTEAD PERIOD (1910–1925)

Between 1910 and 1920 two significant innovations in federal land policy affected ownership in Middle Park in a most profound fashion. In 1910 the

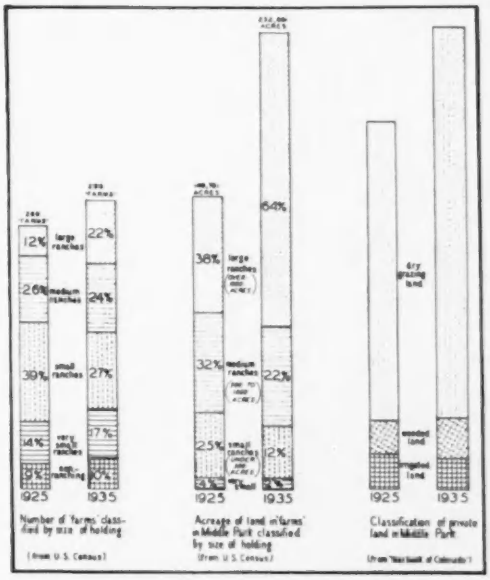


FIGURE 8.—The nature of land changes in recent years. The left figure shows the relatively slight changes in the number of ranches. The middle figure shows that most of the land which passed from public to private ownership was absorbed into the large ranches. The right figure indicates that the homestead period added little irrigated land. The discrepancy in acreage between the middle and right figures results from a slightly different definition of private land used in 1925 by the state and the federal census takers.

FIGURE 9.—A lettuce field on one of the upper terraces of the Colorado River. The crop has not been harvested and is now spoiled.

Homestead Acts were enlarged to permit preëmption of 320 in place of the original 160 acres and the period of residence was materially shortened. In 1916 the Stock-Raising Act further increased the area which could be homesteaded to a full section of 640 acres.

Neither of these changes made any lasting difference in the extent of the cattle business in the Park but they did alter the pattern of land ownership. Not even 640 acres of sagebrush land could make a cattle ranch without the necessary meadows, but many homesteaders came in over the railroad and tried it. Strange things appeared on the ranges; new fences which blocked off long-used pastures, more cattle with unknown brands, and, almost inevitably, a moderately acute shortage of commercial hay for winter feeding. Accompanying these afflictions there appeared for the first time in Middle Park large flocks of sheep which the cattlemen considered, along with droughts and low markets, as a plague upon an honest man's efforts to make a living from the government's grass.

This later homesteading failed almost completely in establishing new ranches. The statistics of the period from 1910 to 1920 show that there were always more than 100,000 acres available for entry at any time. This land, however, had not heretofore been worth owning. There was little if any of the essential meadow land open for entry or for sale at a price the homesteaders could afford to pay. In 1922 the number of homesteaders reached its peak and began to decline. Many of those who weathered the time necessary to "prove up" on their claims sold out to the established ranchers. Some of the claims like those of the earlier homesteading must have been intended specifically for this purpose; with grazing land valued at $3.50 per acre there might have been a little profit in such ventures. After 1925 the homesteading faded rapidly until, by 1928, there were only three homesteaders residing in the Park although the Land Office hopefully advertised that there were still 115,420 acres open for entry. The enlarged Homestead Acts were intended to give the little man a chance in the cattle business; their results were to force the large land user to increase his acreage.

The homestead period thoroughly frightened the ranchers. They saw the best of the public range pass into private ownership, from which ownership they were forced to purchase it in order to use it in their operations. Although the homesteading failed because it was not suited to the conditions as they existed in Middle Park, the Acts still remained in force and plenty of poor land continued to be available. In the fullness of time, perhaps, another crop of "dry-landers" might try again. The ranchers who had the necessary capital purchased or leased what grazing land they needed. Since 1920 the amount of such land in private ownership has increased at a rapid rate (Figure 6).

This is reflected in the steadily growing number of large ranches, those over 1,000 acres, which appear in Figure 5. The specter of another wave of homesteading finally was laid low in 1934 when the Taylor Act removed from entry what was left of the public domain after fifty-five years of culling and placed it under the benevolent administration of committees of local stockmen.

During the homestead period the number of cattle in the Park increased approximately twenty-five per cent (Figure 7) without any increase in the irrigated lands upon which the animals were dependent for their winter forage. Just how the homesteaders intended to feed their cattle is not known. It probably was not profitable to ship hay from the eastern slope for winter feeding and during those years it was not always possible. The tremendous snow drifts on Rollins Pass stopped traffic on the railroad for weeks at a time. Hay trains waited on the eastern side while giant snow plows, hundreds of workmen and volunteer ranchers, labored to open the track. Meanwhile on the western slope the homesteaders' cattle huddled into arroyo bottoms in the thirty below zero temperatures of winter nights and slowly starved to death. The abrupt drop in the cattle population back to the normal twelve thousand between 1920 and 1925 (Figure 7) reflects the post-war depression of the cattle business, but it also seems to show what happened to the homesteaders' cows. The corresponding increase in the number of sheep represents an attempt to overcome the shortage of winter forage. The young of the flocks can be sold as lambs in the fall without the necessity of a winter carry-over which is required for yearling steers.

At the end of the homestead years and after the necessity had passed, the railroad problem was solved. On the basis of taxes levied on real estate holdings along the line, including the city of Denver, the famous Moffat Tunnel was driven under the Continental Divide.

The homestead years were ones in which the forces causing change in the pattern of land holding were at work. Their effects were not fully realized until 1935, a decade after the close of the active homesteading. Toward the end of the period, from 1920 until 1925, certain trends were becoming apparent. The 160-acre unit, either as a base holding or unit for acquisition, faded rapidly (Figure 5). The amount of land added to private ownership (Figure 6) increased steadily as the homesteaders "proved up" and acquired private titles to their holdings. What happened to this land will be brought out by the statistics of the most recent decade of the ownership history in the Park.

RECENT DECADE (1925–1935)

In the period from 1925 to 1935 the land ownership system of Middle Park was undergoing two types of change. The first of these was an absorption of more land into the larger ranches; the second was the development of small holdings used principally for truck farming.

Figure 8 indicates that from 1925 to 1935 a considerable amount of acreage was added to the private ownership. This was composed almost entirely of the dry grazing land homesteaded during the past fifteen years or recently purchased by the ranchers directly from the government and state. This increased the number of large ranches and consequently the amount of land which they contained. In 1925 approximately thirty-eight per cent of the private land was in large ranches; by 1935 this percentage had increased to sixty-four. There are no very striking

changes in the number or area of the other ranch classifications. This does not indicate any enlargement of the cattle business or increase in land utilization. All of the pasturage in the Park has been used, in fact has been over-used, since the first decade after the advent of the ranchers and their herds. It does represent the determination of the successful and solvent cattlemen to possess the land which they need for their operations and to be independent as much as possible of the public ranges.

The number of small holdings which developed in the Park from 1920 until 1935 represents a significant if negative experiment in a different economy. With the connection of Middle Park to the eastern slope by a good motor highway and the completion of the Moffat Tunnel, its isolation disappeared. For agricultural occupation the Park needed only some crop which would grow in the frost-hazarded season and which would be valuable enough to transport to the Denver market.

Lettuce cultivation in small tracts with intensive methods was introduced about 1920. It was a novelty in this area of extensive cattle ranching to which some of the ranchers gave part-time attention. A small number of experienced truck farmers bought land in the Park and a few Mexican and Japanese laborers were added to the population. Lettuce fields became scattered over the terraces somewhat above the lowest meadows along sections of the main stream of the Colorado (Figure 9). In 1926 these fields comprised two thousand of the forty thousand irrigated acres in the Park.

Had the lettuce experiment been successful and permanent, it might have altered considerably the economy of the Park. The removal of irrigated land from the cattle system would have decreased the amount of stock which can be supported through the winters. The "lettuce boom" however was short-lived. Low market prices and heavy competition from established areas were contributing causes along with frost danger, high wages, and lack of organization and standardization. By 1935 only 175 acres of lettuce were cultivated and the irrigated land used for truck gardening apparently had reverted to hay.

In the pattern of land ownership there are still in the Park twenty-five to thirty "farms" of less than fifty acres. These are obviously not ranches and cannot be correlated with the regional economy in any general way.

FIGURE 10.—Driving a herd of yearling cattle into the shipping pens at Frazer.

Some of them are rural residences of persons occupied in the towns, others are the property of operators of cabin camps and summer hotels. The amount of land which is contained in small ownership is insignificant in comparison with the total area and hardly would make one large ranch if placed together.

Summary

Although Middle Park was opened up by a mining economy, its present settlement is based upon cattle ranching. It is one of several "wide places" in the Colorado Rockies where irrigated hay can be grown for winter forage and from which grass-fattened cattle can be shipped to the lowland markets. The original cattlemen, following the traditions of their times, acquired the meadow lands along the streams and used the public uplands for grazing their stock. The cattle economy rapidly expanded to its maximum proportions and might have continued indefinitely had not changes in the homestead laws threatened the system by allowing much of the upland range to pass into homestead tenancy where it could not possibly function because of the lack of the complementary lowland meadows. Since that time the larger and more successful ranchers have been adding this upland to their holdings that they might continue to use it. The effect upon the pattern of land ownership has been an increase in the number of large ranches and the amount of land in these large units.

CRANBERRY INDUSTRY OF THE PACIFIC COAST

Albert L. Seeman

THERE are but few sections of the United States that have the environment which is necessary for the growing of the cranberry and small sections of western Washington and western Oregon are included on that list. The principal sections of the United States producing this fruit are the Cape Cod region of Massachusetts, the Pine Barren region of New Jersey, central and northern Wisconsin, the Pacific Coast, and small areas in a few other states. There are but few cranberries grown outside of the United States. About 100 acres are cultivated in Nova Scotia and small areas have been planted in the Scandinavian countries. The states of Massachusetts and New Jersey account for nearly ninety per cent of the total acreage in the United States.

Lewis and Clark found the Indians near the mouth of the Columbia River gathering the native wild cranberry from the bogs in that vicinity for their own use and for trade with the upper river tribes. This wild cranberry (*Vaccinium oxycoccus intermedius*) grows in swamp or peat soils west of the Cascade Mountains in the state of Washington. The native wild variety is of good quality but has no commercial importance as the berries are very small. While there is some dispute as to the origin of the word "cranberry" the best sources state that the appearance of the flower in the bud has probably suggested the name cranberry or "craneberry." Just before the flower opens, the stem and flower resemble the neck, head, and bill of a crane.

The first planting of the cultivated cranberry in the state of Washington was made in 1881 by the Chabot brothers near Long Beach. The planting was modeled after the Massachusetts bogs near one of the lakes to insure an adequate supply of water for irrigation and frost protection. Other plantings were made from time to time by a few others who followed the example and methods of Chabot. From about 1909 to 1916 there was a rapid increase in acreage near Ilwaco and Long Beach due to an artificial real estate impetus. Several hundred acres were planted during this period, many of which proved unsuccessful. The reasons for so many failures were that many of the bogs were in unsuitable locations, most of the growers were inexperienced, poor varieties of berries were planted, and many of the planters did not have sufficient capital to see the project through to completion. Some of the projects which failed, but which were in the better locations, were later reclaimed by the successful growers and made a part of their holdings. In 1924, near Grayland, a few small tracts of one to five acres were planted. About ninety per cent of the acreage in that vicinity is now owned by people with Finnish names. Formerly these Finns were employed in logging camps and then as the timber operations were closed down they followed the first Finns and started cranberry growing. The acreage near Grayland has increased steadily since 1924. While it is impossible to state accurately the number of acres planted to cranberries,

it has been estimated that at present there are between 700 and 800 acres in the state of Washington. Not more than one-tenth of the bogs which can be used for cranberries have been improved.

The first attempts at cultivation of cranberries in the state of Oregon were made by Charles D. McFarlin, a Cape Cod grower, who came to Coos County and set out vines which he brought from Massachusetts in 1885. The McFarlin variety was developed by him and his brother. In 1911, C. N. Bennett put out the first bogs in Clatsop County. By 1927, the acreage had increased to better than 100 acres in Clatsop County and 30 acres in Coos County. That year marks the date of greatest acreage for, since then, production has steadily decreased. The growers, for some reason, did not give sufficient attention to their bogs, and weeds crowded out the vines. In 1940, the area in Clatsop County was between 40 and 50 acres and in Coos County about 25 acres, and only two new bogs were being prepared for cultivation.

The environmental and economic requirements are rather exacting and experience in ordinary lines of farming is of little value in cranberry production.

The cranberry plant requires an acid peat soil. The depth of the peat in the bogs which are used varies from 8 or 10 inches to more than 10 feet. The shallow peat bogs are not so good as the deeper ones, for the superficial bogs will not retain moisture readily and are easily depleted of their plant food. Brown sphagnum peat is better, in Washington and Oregon, than bogs of decomposed leaves, grasses, sedges, decaying wood, or of heavy black muck. In bogs other than sphagnum the cranberry leaves have a tendency toward excessive growth and various diseases are more of a problem.

The location of the peat bog is another important factor. It should be located close to an abundant supply of sand or fine gravel. Sand is used as a mulch over the peat for it helps check

FIGURE 1.—Location of Pacific Coast cranberry fields.

evaporation, provides a good medium for the root to grow, and makes weed control less difficult. Also, sand is warmed more readily during the day than peat, and at night the radiation helps counteract the low temperatures to which peat bogs are subjected. If the bog is located in an enclosed depression poor ventilation may give rise to frost pockets.

The bogs used for cranberries are especially subject to frost. This condition is partly due to the location of the bog, almost always within a mile of the ocean, and partly to the nature of the peat soil. Many of the bogs are less than 15 feet above sea level. On Washington bogs, frosts occur during clear, calm nights, sometimes as late as June 20. They may occur, also, after warm clear days with a low relative humidity, or following a morning rainstorm when the weather clears and the loss of water by surface evaporation is very rapid. Frost injury and heavy vine growth are closely related. Where the vines are dense and matted, the sun's rays are unable to penetrate and warm up the ground during the day, so there is little absorbed heat to be radiated at night either from the soil or from the vines. Various methods of frost protection have been tried. Pruning the vines is always an aid. Orchard heaters of various types have been tried but have not proved satisfactory due to (1) cost, and (2) tramping on the vines in taking care of the heaters. Since 1932, wind machines have been used and some protection may be obtained if the frost layer is less than 20 to 30 feet. Re-sanding is also used with satisfactory results. Flooding is the most satisfactory and economical method of preventing frost injury. Plants are not damaged by flooding even if covered for periods of a few days. Frosts which are injurious to the crop at harvest time are of rare occurrence but do occasionally happen. More frequently, frost damage occurs during late spring and early summer.

FIGURE 2.—Type of flora on bog before clearing for cranberry planting.

Depressions are not suited for cranberry growing for, in addition to the frost factor, water drainage is more difficult or impossible. An adequate water supply is necessary, but since in western Washington and western Oregon the water table is only two to four feet down, it is not a serious problem. A hole dug five to eight feet will insure adequate water throughout the year for irrigation and frost protection. If the sand is infested with horsetail rush (*Equisetum Sp.*) it should be avoided for the weed is extremely difficult to eradicate.

The economic requirements, including

finances and labor, are likewise exacting. These will be discussed in the paragraphs on the preparation and operation of the bogs.

The peat bogs along the coast of Washington and Oregon have little heavy timber which needs to be removed. Such plant growth as is present can easily be removed, for the shrubs and trees have their roots close to the surface. On some bogs stumps of former forests must be blasted out. After the land has been cleared of vegetation cover, the bog is "scalped" to a depth of 4 to 18 inches. Some of the peat from the "scalping" is used to fill in the holes and level off the surface. The rest is sold, or used in building dikes around the field. After the "scalping," clean white sand is spread to a depth of three or four inches.

The cranberry is grown from cuttings planted directly in place without previous rooting. These cuttings are pressed through the sand into the peat below and take root; by the succeeding year they have sent out runners. At the end of three years the marsh is producing but does not come into full bearing until the fifth year. Weeding is especially important during the early period. Many varieties of weeds are troublesome, some of which can be checked and others are still a serious problem. Many insects attack the cranberry; some measure of protection has been found against some of them. Control of insects and weeds is the result of experiments by the United States Department of Agriculture and the Washington State College Experiment Station.

The total cost of bringing an acre of bog land into production is from $1,100 to $1,500; this figure includes ditching, weeding, operating, and all of the other costs.

Many varieties of cranberries have been tried and are grown. The McFarlin variety is the most important and now produces 90 per cent of the total crop. It was developed in South Carver, Massachusetts, and brought to Oregon and then to Washington. The berries are large and irregular in size, oval in form, and have a slight pubescence which makes them less attractive than some other varieties. The vines are given to runners and consequently are poor for scooping so that the berries must be hand picked. The yield is about 50 to 60 per cent greater than the Howe variety. The Howe variety was originated in East Dennis, Massachusetts, and is second in importance. The berries are medium in size, dark crimson color, oval in form, of good keeping quality, generally sold for the Christmas

FIGURE 3.—Bog which has just been set with cranberry cuttings.

FIGURE 4.—Cranberry bog about three years old.

trade, and they mature about ten days later than the McFarlin variety. The vines are excellent for scooping and therefore cheaper to harvest; the vines are very strong and may break the scoop tines.

The harvesting of cranberries starts about the fifteenth of September and continues until November first. The two methods of gathering the berries are hand picking and scooping. The scooping method is much faster. However, the loss of berries by the scooping method varies from 10 to 20 per cent and there is some damage to the vines. Hand picking is done chiefly by women, although men and children are also employed. Migratory fruit pickers frequently end up the season by picking cranberries. The hand pickers are paid for the quantity picked. While prices paid for picking vary from season to season the normal rate is 35 cents per measure which is about one-ninth of a cranberry barrel or about 10 to 12 pounds. The pickers can gather 8 to 20 measures per day.

Before hand picking starts the fields are lined off in rows and a picker is assigned to a strip so as to give individual responsibility for clean, careful picking. A foreman supervises the work and makes checks to insure careful picking.

Scooping is done exclusively by men and is chiefly day work. Payments for quantity scooping are made only toward the close of the season to hasten the harvesting of the crop, or if the

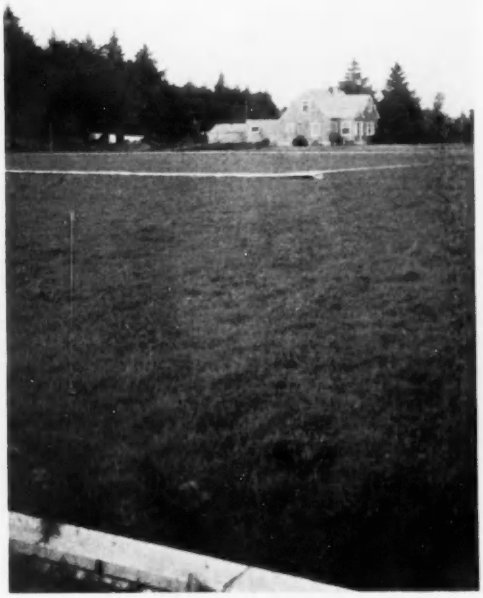


FIGURE 5.—Cranberry bog in full production. Typical Finnish grower's home in background.

yield is light. An experienced scooper can harvest 5 to 15 barrels per day.

The berries are taken from the bogs to the packing shed in the field boxes. Each grower has his own shed to take care of his crop and, as a rule, members of the family take an active part in preparing the fruit for the market. The berries are first put through the screening separator where the vines, weeds, and leaves are first removed by a fan blower. The sounding board then separates the soft berries from the sound ones, and then the sound berries are graded according to size.

About 75 per cent of the berries from Washington are sold through the Growers' Marketing Association under the Pacific Cranberry Exchange Brand.

FIGURE 7.—Typical warehouse used for sorting and packing.

FIGURE 6.—Cranberry field lined for picking at harvest time.

Some growers, however, prefer to sell independently and much of their stock goes to chain stores or is consigned to commission houses. The berries from Clatsop County, Oregon, are sold through the same exchange or independently and all from Coos County, Oregon, are sold through chain stores. Practically all of the fruit is shipped in standard one-quarter barrel boxes which equal 22 quarts and vary in weight from 23 to 26 pounds, according to the variety and texture of the berries. The berries are placed on the market shortly after the first of October. The growers receive an average price of about $4.50 per box. The yield is from 100 to 400 boxes per acre; the variations are due to location and soil conditions of the bog, weather conditions during the

growing season, and other factors. Thus, the gross return per acre is from $450.00 to $1,800.00. Since a bog will produce 20 to 30 years after the plants come into full bearing, which is the fifth year, some idea can be gathered of the returns per planting.

The price for all cranberries produced in the United States is set at the fall meeting of directors of the American Cranberry Exchange held each year at Cape Cod, Massachusetts. Since the Exchange represents about 90 per cent of the crop of the big eastern producing section, the price which they set dictates throughout the United States. The freight charge on a barrel of cranberries from the eastern exchange to the Pacific Coast is $2.70 and this is added to the eastern price in selling western berries.

The market for Washington and Oregon cranberries is western United States as far east as Salt Lake City. This western market is not exclusively restricted to western producers for about one-fourth to one-half of the cranberries consumed come from eastern fields. With unemployment and with a large home market it can be understood why acreage in cranberries has increased steadily in Washington especially since 1930. Those berries which cannot be sold as fresh fruit are sold to canners in Portland. This has greatly increased the market.

The cranberry industry, while comparatively new on the Pacific Coast, has become an important feature of the agriculture of Pacific and Grays Harbor counties of western Washington. The abundance of other fruits on the market has but little effect on the price of cranberries as there is a very definite seasonal demand for this fruit. Since the cranberry can be grown only where certain soil and climatic conditions are found, overproduction of this fruit appears unlikely.

GEOGRAPHIC ASPECTS OF MILLER COVE

L. LeMar Stephan

EVERY year more tourists visit the Great Smoky Mountains National Park, renowned for its scenic beauty. Subdued land forms; rounded peaks dotting crest lines; scattered grassy summits; forested slopes flanking widened valleys; coves; waterfalls; and recently incised gorges, comprise distinctive features in the landscape. The outcropping rocks are crystalline generally. One of the main routes traversing the Park from the northwest leads through Miller Cove, a fertile, eroded limestone valley nine miles long by three-quarters of a mile wide (Figure 1). Historically, the enclosed valley was as isolated as nearby Wear and Cade Coves are at present. The dominance of the earlier unilateral relationship of the Cove with the valley, particularly the urban center of Knoxville, was destroyed when the routeways through the Park opened up new interests and values among the mountains themselves and toward the lands beyond.

Type Landscape

The natural features are grouped in accordance with the northeast-southwest valley trend and different underlying rocks. In minor ways the landscape of Miller Cove is analogous to that of the Shenandoah Valley, in that the

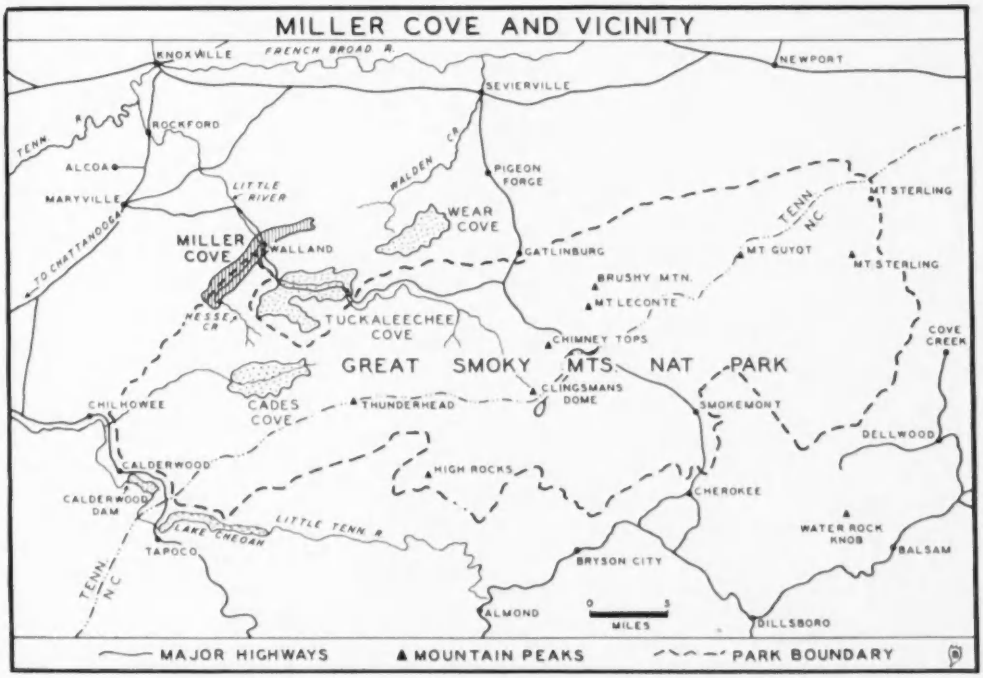


FIGURE 1.—Peripheral location of Miller Cove at the northwest flank of the park on a main highway from Knoxville is advantageous for tourism and accessibility. Note southeast quadrant of cove is within park domain. A projected motor road leading to Sevierville from the northeast angle of Miller Cove would substantially increase local activities and improve Walland's situation as a major gateway into and out of the park.

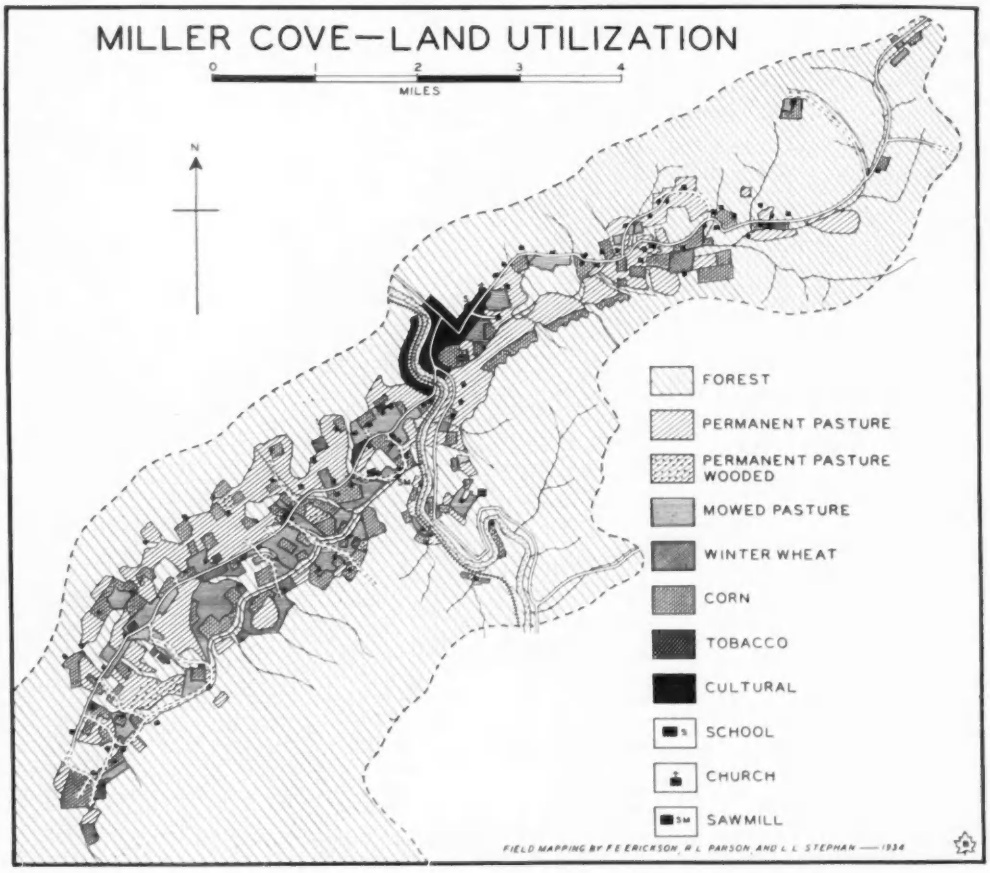


FIGURE 2.—Agricultural land utilization conforms to the trend of the enclosed valley and ends irregularly about the bases of surrounding mountains. Lobes of forest penetrate the valley floor here and there, and wooded sections are interspersed with pastures and crops. Corn fields dot the lower mountain flanks, alternating with small pasture tracts. Pasture areas are generally larger than cropped fields, both assuming irregular shapes. Access to Walland, and outlet from Miller Cove at that point, is afforded by crushed-rock roads which traverse the length of each arm of the valley.

floor of the Cove is a small rolling plain, traversed by three low ridges, which parallel each other along the longitudinal axis of the valley. As in the Shenandoah Valley, the unreduced ridges appear well utilized; irregular field patterns are continuous with those of the valley floor on either side. Semi-circular pastures and hay fields dot the valley ridges and the lower mountain slopes flanking Miller Cove. The grazing of cattle forms one part of the farming program. Irregularly rectangular fields of corn, winter wheat, and tobacco of various size, and rotation pasture characterize more fertile portions of the valley floor. Wooded stretches separate farmed fields and obstruct vision across the valley. Scattered mounds of sawdust reveal former sites of portable sawmills, for lumbering activities continue to play a prominent part in the economy of the Cove. Eroded and abandoned fields display long and careless use, exaggerated beyond any similar condition in the Shenandoah. The array of Miller Cove activities, together with the character of landscape features,

reflects local responses to limestone soils, use of available materials, and a few "outside" influences and interests.

From northeast to southwest along the gravel road that traverses the length of the Cove, an increase in size and appearance of prosperity of the farmsteads is strikingly evident. The apparent prosperity closely correlates with the actual relative value of farms in the narrow northeast as compared with the wide-floored southwest. Houses in the upper Cove are frequently of only two rooms and usually lack paint entirely. Toward Walland, centrally located town of the valley, dwellings become five-room painted cottages. In Walland itself and southward, there is a generous proportion of well-built, neatly kept, two-storied houses. Interspersed among the large homes, which appear to date back one generation, are small trim cottages of the type associated with mill workers of higher income. The houses are comparatively new, many having been built in the last five years. They are, in fact, occupied by employees of the Alcoa Aluminum Company, who devote part of their time to farm activities. On the slope of the encircling mountains to the south, not in the Cove proper, stands a cluster of typical week-end homes, owned by residents of Maryville organized into Mountain Homes, Inc.

STRUCTURE AND SURFACE FORMS

The well-developed, submature topography of Miller Cove has been carved out of a formation (Knox dolomite) softer than the surrounding crystalline rocks. Miller Cove is not a geologic window or inlier as are Cade, Tuckaleechee, and Wear Coves, but a strike valley developed on Knox dolomite (Cambrian and Ordovician), eroded by, or at least occupied at present by, Hesse and Read Creeks which run at the edge of the bluish-gray Pigeon slate (N. M. Fenneman).

Little River, a tributary of the Tennessee, bisects the Cove. Hesse Creek drains the northeast section, Read Creek

FIGURE 3.—Clouds forming from warm air rising from the Tennessee Valley and chilled as it drifts up and over the Chilhowee range eastward into Miller Cove. As they settle lower into the cove they are dissipated adiabatically. (Courtesy of W. Elmer Ekblaw.)

the southwest, both streams entering Little River and adequately draining the valley. A few underground streams associated with caves form karst. A number of springs furnish clear pure water for farm families.

Decay of the softer Knox formation is rapid, and deep soil of considerable fertility forms in the valley floor portions. Sandstone and shale are, however, interbedded, persisting in the several small ridges traversing the valley. Wherever the formations spread out at a low dip, the valley and smooth ridges are broad and where the strata dip steeply, the valley is narrow. The harder Hesse sandstone (Cambrian) in the extreme northeastern and extreme southwestern sections of Miller Cove readily accounts for valley narrowing and irregular tapering. Thin and slaty soils capping interlacing small ridges and knobs are erosional remnants of Pigeon slate in the southeastern section flanking the bordering mountain. Nebo sandstone forms Chilhowee Mountain on the north; other Cambrian quartzites (and associated rocks) comprise the remaining encircling mountains. The forested slopes tower 1,300 feet above the valley floor to attain an average height of 2,300 feet.

FIGURE 4.—The northeast arm of the cove is narrow and shows more area in forest than the valley as a whole. (Courtesy of W. Elmer Ekblaw.)

CLIMATE

The sheltered site of the Cove produces local weather peculiarities typical of mountain valley recesses, but the latitudinal location provides a usual regime of humid warm temperate conditions. Annual temperatures average approximately 57 degrees, while precipitation totals 55+ inches. Agricultural yields fluctuate little as precipitation above one and one-half inches falls every month, with a maximum of nine inches in June. Some snow falls during winter months, to form a protective covering for winter wheat. The temperatures are relatively high throughout the year, with winter temperatures averaging slightly above freezing. Summers are pleasant yet sufficiently warm for successful growth and maturation of crops, July and August both averaging 77 degrees. Frosts are likely to begin the later part of October and end the middle of April. The growing

FIGURE 5.—To the southwest there are larger level fields than in the rest of the cove. The encircling mountains toward the south show fairly steep slopes.

season of 193 days permits satisfactory variety of crops in the farming program.

EARLY OCCUPANCE

Miller Cove was originally inhabited by Cherokee Indians who mined a hidden vein of lead, used for making bullets. Since the site of this old mine is unknown, although older settlers believe the mine is somewhere in the southwestern portion, no lead is now extracted.

First white settlers moved into the Cove about 1800. Their mode of life was circumscribed by isolation and only subsistence farming was possible for them. Black and brown bears, deer, wild turkeys, partridges, and squirrels provided their meat. Even today limited hunting of the same animals is pursued. The early settlers used local wood in numerous ways—for fuel, construction, tools, etc.—as is typical of Appalachian folk. Life was hard, and occasional troubles with Indians multiplied the hardships.

FIGURE 6.—Fences enclose the irregularly-shaped fields and pastures. Some formerly cropped sections are at present reverting to timber.

MODERN ECONOMY

The year 1902 marked a turning point in the economy of the Cove with construction of a tannery by the England Walton Company (Sloescher Tannin Company). Hemlock, chestnut-oak, and black oak were purchased by the concern from Townsend Lumber Company for tanning purposes, but eventually a disagreement between the two companies terminated their association. Private woodlots were then purchased in and about Miller Cove to provide bark used at the tannery. Raw hides were shipped in, and the processed leather shipped out. No factories for the fabrication of leather goods in the vicinity were established. The tannery continued to function, employing seventy persons, until 1931 when it was destroyed by fire. Remains of the brick and stone foundation on the original site in Walland are evidence of a prosperous chapter of the past.

FIGURE 7.—Unreduced valley ridges are high enough to obstruct the view across the valley. This combination of pasture on the lower slopes and forested crests is representative.

Today the majority of people work in the aluminum plant at Alcoa, Tennessee (a small town near Maryville) about twelve miles away. Special buses

FIGURE 8.—Tilled crops occupy the more level and fertile portions of the valley floor. Cattle may be seen grazing on the hill slope beyond the field of corn.

run from the Cove every four hours to meet each change of shift. The eight-hour work shifts leave time for cultivation of garden plots and small farms. Thus, part-time farms intermingle with subsistence farms in the countryside.

Miller Cove lies in the corn and winter wheat belt. The land use map (Figure 2) shows general distribution and irregular patterns of crop land, pasture, and forest. Most of the land from base to base of the mountains is in use, the greater part being devoted to permanent pasture with some large sections of mowed pasture. Holstein cattle predominate, there being in addition a few Red Durham and Polled Angus. Rotation pastures are in Japanese and red clover and timothy. Fields are dotted by hay-stacks supported by central poles.

Winter wheat is important in farming programs of both farm types. Yields are not very high, averaging twenty bushels per acre. Grain is sown in mid-October and harvested in June for use chiefly as feed. Some locally produced wheat is milled at Perry's Flour Mill in Walland.

Smaller field plots are planted to oats, Irish potatoes, yams, sorghum, tobacco, cotton, and various other crops. Apple, peach, and pear trees afford variety at family dinner tables. Some crops represent cash return, while others aid substantially in the rôle of crop rotation to maintain soil fertility. The crop rotation practiced is corn, winter wheat or spring oats, and Japanese clover. The clover is grown for two years and is then followed by corn, or left fallow. Stable manure, cottonseed meal, and commercial mixtures are all used for fertilizing fields except those in permanent pasture.

Cultural landscape features in the northeastern half of the Cove indicate responses to poorer conditions than those of the southwestern portion. The narrower valley and smaller accumulation of fertile soils suggest reasons for the smaller farm holdings, smaller fields, and inferior animals, homes and barns. Farms here average fifty acres. Holdings around Walland and to the south average one hundred acres. At least one farm totals 250 acres. Part-time farms are more pretentious than subsistence farms as a rule. Larger applications of labor and capital are involved and cash crops are emphasized. Women and children work hard on all farms in the Cove. No labor is imported.

Forests play almost as important a rôle as soils in the human economy of the Cove. Originally trees clothed the rolling valley floor as well as the flanks of the mountains. Miller Cove lies in the belt of oak, chestnut-oak, yellow

FIGURE 9.—Haystacks in Miller Cove are supported by a central pole. Timothy, Japanese, and red clover are grown for hay.

poplar forest association. Though these species predominate, seventeen others enter into use; some of which are yellow birch, white and slash pine, black gum, maple, hemlock, sycamore, and walnut. The high annual and well-distributed rainfall accounts for large trees, thick stands, dense underbrush, and rapid regrowth. Areas now denuded and too poor for agriculture are in pasture or fallow, while, on the whole, lower sections of better soils are utilized for crops. Today timber furnishes ample supplies of wood for homes and farm buildings and for fuel for cooking and heating. In addition, there is ready sale for dead chestnut trees, and for hemlock and chestnut oak to be used in tanning.

FIGURE 10.—Many neat cottages of part-time farmers are situated at the foot of Chilhowee Mountain with cultivated fields lying between the house and the road.

Prior to 1931 the Sloescher Tannin Company bought cord wood locally. The plant was not rebuilt after being destroyed because the company was at the time of the fire in litigation over the use and pollution of Little River. Now most of the lumber cut in the Cove is bought or owned by the Mead Company. Shipment by rail is made direct to Harriman, Tennessee, only a small part reaching other company plants, such as one at Knoxville. At present cord wood brings $4.25 a cord yarded. Lumber supplies in the Cove promise a continuance of income from lumbering activities for years to come.

FIGURE 11.—This sawdust pile reveals the site of a farmer's saw mill. Lumbering activities remain an important part of the economy of Miller Cove.

There is little fabrication of wood products in the Cove. One small outdoor establishment turns out plain, armless chairs. Operation of this plant is intermittent, depending upon orders received.

Miller Cove is crossed from east to west by State Highway 73, a first-class highway, and by Little River Railroad. A third-class road of local gravel which runs northeastward-southwestward, is virtually impassable in the northeast. Within a year this highway is, however, to be improved and extended northward over the mountain to connect with a road from Sevierville. Completion of the project will undoubtedly increase the number of tourists coming through Walland.

FIGURE 12.—A lone wood products manufacturing plant reflects modern adjustment to copious supplies of timber.

Walland, with a population of about three hundred, is situated at the juncture of the two roads. It functions largely as a rural market center for occupants of Miller Cove. A minor function of the town is to serve passing tourists with overnight accommodations in Chilhowee Inn, advertised as "The Vacation Hotel." Residents receive visitors hospitably. Buildings in the town are rather widely spaced, and homes, as well as surrounding farmhouses, are large and neat, often two-storied. They spread for several hundred yards northeastward and southwestward from Walland into each arm of the Cove.

The economy of Miller Cove is unlikely to undergo much change. Agriculture will continue to be the basic occupation in the form of subsistence and part-time farming. Farm incomes will be supplemented by cash from work in the aluminum plant, lumbering activities, and tourist trade. Opening up of the road to the northeast should somewhat increase the number of tourists and improve opportunities for lumbering.

On part-time farms some dairy produce is sold for cash, while owners of subsistence farms consume their somewhat more limited produce.

Some fallow land is set aside annually, but the remaining land, as mapped, is planted in corn and winter wheat. Warm temperatures and well-distributed rainfall combine to result in auspicious growing conditions for corn. Only cool nights fail of making conditions optimum for growing requirements. Early in April corn is planted in rows drilled, usually, with two-row planters, except on steep slopes where a one-horse planter or hand sowing become necessary. Corn generally is husked on the stalk which is topped for seed maturation. Harvesting of corn occurs about the middle of October. The grain is grown for feed for animals and poultry and for human consumption. Some corn is converted into "corn likker" which forms an easily transported cash product.

RIBE

W. R. Mead

AMONG the cities of Denmark, few have a more interesting history than Ribe and none illustrates more effectively the modifications in geographical values which accompany the process of historical change. Ribe is included among the six oldest settlements of the kingdom. It claims a continuous existence since the ninth century and over a period of five hundred years flourished as the second port of the country. Throughout the Middle Ages, it was the greatest commercial center in Denmark after Copenhagen. It was the *Portus Danorum* of the west coast as the capital was the gateway of the east. The strength of its geographical location lay in its relationship both to sea and land. All forces seemed to combine in its favor and to promote the position of eminence which it held in late medieval times. Thus, even though it lay beyond the pale of the great commercial system of the Hanseatic League, it rivaled the Staple towns in the magnitude of its wealth and the intensity of its commercial contacts.

It is the aim of this article to analyze the "fortuitous concourse" of circumstances which operated in space and time to give to Ribe its prolonged preeminence. Before proceeding to the physical forces and strategic factors, however, two facts must be mentioned. In order to give perspective to the following description, it must be borne in mind continually that the Denmark of medieval and renaissance times represented a completely different force in the European system from that which it represents today. Early consolidation and centralization gave to it a strong position in relation to the unconsolidated patchwork of states of the adjacent continental rump. Secondly, Ribe, at the height of its power, was never any larger than at the present time; but a population of 5,000 persons was a body of considerable size in those times, when the population of the entire country was probably less than a sixth of its present total, and a generally self-sufficient rural economy gave little stimulus to urban agglomeration.

In the complex of forces which operate to promote the rise of a city, two distinct groups may be distinguished: the forces of local or topographical position and the forces of regional location. In the incipient stages of the growth of a city the influence of the former is usually stronger. Ribe grew up against the background of a zone of contact between the water gorged "watten" and the arid, permeable outwash plain of northern Schleswig. If the bleached and podsolized soil of the "geest," together with a relatively dry and windy climate, reduced the agricultural potentiality of the plainland, there were compensating advantages. (The low value of the land according to the old "hardcorn" classification is stressed in Pontoppidan, *Danske Atlas*, Vol. V, p. 643, Kobenhavn, 1763.) Thus, the absence of woodlands obviated the need of tiresome clearance for early settlers, the wealth of fish and fowl from the margins of the "watten" ensured a never failing supply of food, and the marshland grasses provided fodder for domestic animals. Along the eastern littoral of Schleswig, the same natural influences are operating as in the zone of contact between the Fens and the Breckland of Norfolk. During the

Dark Ages, it may be imagined that human activity was similar in both regions.

The topographical location of Ribe, a virtual island within the encircling waters of the navigable Nipsaa, provided a patch of *terra firma* relatively secure both from human attack and maritime invasion. From the human standpoint, protection afforded by the sweep of the river was supplemented by the treacherous quasi-maritime lands to seaward. The site, some fifteen feet above sea level, offered comparatively solid banks for bridging, and Ribe became a bridge town about 1200. With human control of the upper stream, potential water power resources were revealed. Moreover, the nucleus of the settlement, lying upon the "Inner Edge" of the coast, provided a certain amount of protection from pirates, without challenging the accessibility of the site as a port. The shifting sandbanks and intricate channels of the Ribe "Vorstrand" were also defensive factors.

Consider now the regional location. Ribe is situated at the root of the Cimbrian peninsula, where the isthmus between the North Sea and the Baltic reaches its narrowest dimensions, e.g. Ribe–Hadersleben and Ribe–Kolding are both approximately thirty miles apart. Since early historical times there has been comparatively intense movement across this neck of land and Ribe has shared in this. Shipping in the medieval period as well as in the Dark Ages avoided the Skagen routeway as much as possible and evolved advanced methods of portage for crossing the Jutish isthmus. Secondly, Ribe possessed a sheltered anchorage along a coast singularly devoid of protection

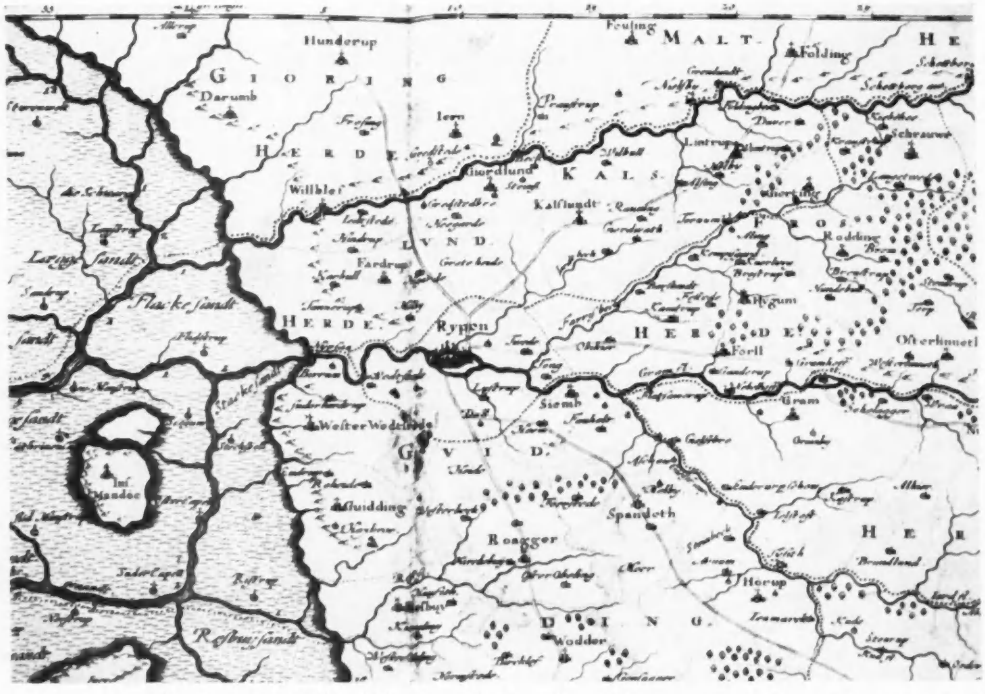


FIGURE 1.—The location of Ribe (Ripen) at the junction of the outwash plain and the marshland of Schleswig. The situation upon the inner edge of the coastline in a favorably retreated position and the convergence of routeways upon the city are clear. (From J. Meyer and Caspar Dankwerth, *Neue Landbeschriebung der Herzogthümer Schleswich und Holstein*, 1652.) (Courtesy of the British Museum.)

FIGURE 2.—The essentials of medieval Ribe are summarized in this print of the city's profile. The ecclesiastical and military functions are outstanding and the commercial life of the city is represented by the variety of vessels plying upon the Nipsaa. The herds of cattle in the foreground speak of a traditional Danish industry and the cumbersome haywains moving into the city indicate the demand for fodder in a port where live animals were assembled for shipment abroad. (G. Braun and F. Hohenbergius, *Civitates Orbis Terrarum*, Liber 5, No. 33, 1573–1618. The following summary of Ribe is attached to the map: "Neq. certe ulli maritimarum vicinarum cedit, aut fitus ac portus opportunitate . . . Sita est enim haec Cimbricae Danicae urbs, i ripa Oceani Australia Gothiae proxima, loco herbido pascuo, fertili atque salubri.") (Courtesy of the British Museum.)

from the North Sea gales. South of the Skallingen Huk, the cordillera of duneland which forms the "Iron Coast" of Jutland is breached and the remaining island remnants form natural breakwaters which offer secure anchorage. Ribe, approached along the Ribe "deep" which is the submarine continuation of the Nipsaa channel, lies in the lee of Fanö and Röm. Thirdly, Ribe is located upon the shortest route from Sjaelland and the capital to the North Sea. Fourthly, the natural features of the Schleswig isthmus which control the land routeways, together with the geographic inertia of Ribe, favored the convergence of land traffic upon the site.

The site occupied by Ribe was settled in prehistoric times; but not until the decline of the Viking era and the establishment of permanent trading and cultural contacts, did the town come into its own. The foundation of the Domkirke by St. Ancharius in the later half of the ninth century and the elevation of the town to a bishopric in 948 marked the beginning of a new epoch. The Viking spirit declined before the civilizing influence of Christianity. The cathedral of Ribe is the oldest church in Scandinavia and from it the Christian doctrine was spread throughout the North. The power of the church during the Middle Ages guaranteed Ribe a leading place in the history of Denmark. Apart from the movement of commodities stimulated by the church, there was a vigorous movement of clergy and scholars. Thus, Ribe was an important center for pilgrims journeying to the holy shrines of Europe (e.g., the pilgrim routes to Mainz and the Rhine valley mentioned by Hugo Mattheisen, *Middelalderlige Byer*, p. 91, Kjobenhavn, 1927) for churchmen from the north departing for places of learning in France and Italy, and for Crusaders traveling to the Holy Land. (*Nordiske Studierejser i Middelalderen*, Ellen Jorgensen. Historisk Tidsskrift. 8 R. 5, pp. 331–382.) Single student journeys to Paris over Ribe were already undertaken in the twelfth century; while after 1300, students from as far afield as Abo in Finland were participating in the great "trek" over Ribe. An interesting route for pilgrims and crusaders to Palestine was given by Adam of Bremen. From the Danish port, the coasting route—which was undertaken without the aid

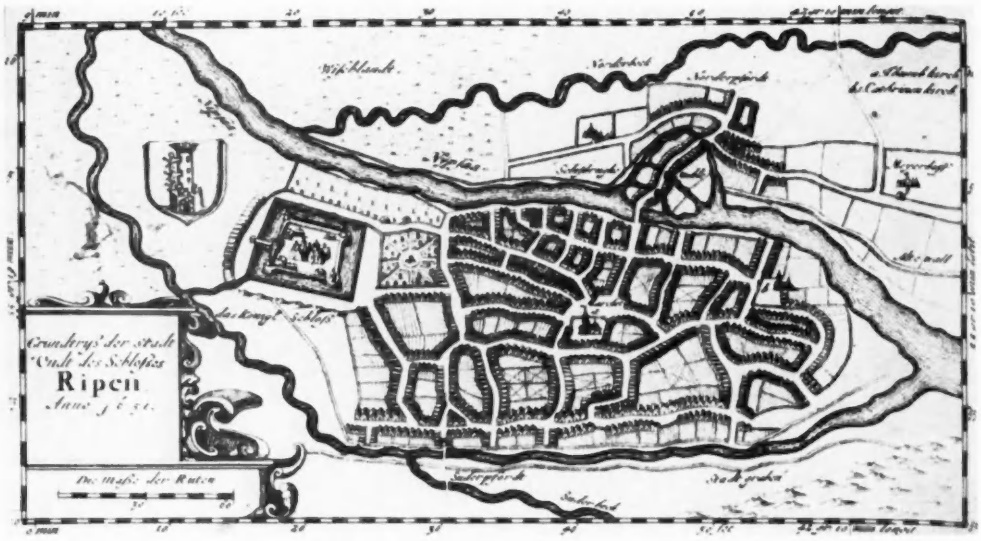


FIGURE 3.—Plan of Ribe in renaissance times. The virtual island nucleus recalls the site of many settlements which have since risen to power. The castle, upon the seaward side of the town, indicates the direction from which attack was anticipated. The function of the town as a bridge town is also evident. Ribe has not grown much beyond its medieval confines and the present settlement is still largely restricted to the island center. In his interesting monograph upon the two settlements of Esbjerg and Ribe (*Schriften der Geographischen Instituts der Universität Kiel*, 1937) G. Neufeldt has prepared an illuminating plan to show the growth of Ribe.

of compass—took some 35 days of sailing. See *Adam of Bremen*, tr. C. L. Henrichson. Kjobenhavn, 1930. Schol. 99.) The influence of the religious factor in early commerce can also be appreciated from the fact that the Danish colony of merchants in London established as early as 1040 their own church of St. Clement Danes. (A. Bugge, *Die Nordeuropeische Verkehrswege*. Vierteljahrschrift f. Sozial u. Wirtschaftsg. IV, 1906, pp. 261–2.) In the thirteenth century, "The Era of the Valdemars," the Domkirke began to assume its present form and a stone structure superseded the former wooden building. The absence of building stones in the Schleswig isthmus meant the importation of constructional materials. The volcanic stones of which the cathedral is built were derived from the middle Rhine. The transport of these materials to Ribe is evidence both of the wealth of the church and the intensity of commercial contacts in medieval times.

Ribe performed a four-fold function in the Middle Ages. We have paid regard to its ecclesiastical origins. To its religious function were rapidly added administrative duties and it became a military stronghold with the erection of a fortress. Ribe was by nature a market center and preëminently a port. Let us notice the salient features of the political location of the city. With the emergence of distinct national units, Schleswig Holstein became a border zone, the sovereignty of which was contested by the rival royal houses of Denmark and the German states. The confines of the Cimbric peninsula had been regarded hitherto as the Eider River in the neighborhood of which the strategic Danewirke was constructed. Changing political fortunes in the Middle Ages modified the status of the Border provinces of Schleswig and Holstein, with the result that Ribe became upon occasion, e.g., after 1240, a frontier town and a corre-

spondingly important strategic stronghold. As the principal city of the Jutish isthmus and the ecclesiastical focus of a wide region, Ribe was often the center of the royal court during the time of the powerful Valdemars. On the other hand, its relatively exposed position upon the outposts of the Scandinavian world also made it the subject of assault in time of conflict.

It is, however, as a point of exchange that medieval Ribe is of most interest to the geographer. The functions of the city as a market center and as a port were closely allied. Ribe was the only great commercial center of Denmark upon the west coast and all exchange of importance with western Europe proceeded through its channels. As a market center, Ribe was the point of assembly for products not only of the surrounding region, but also for the greater part of the Danish kingdom proper. The products marketed in Ribe differed little from those which are now dispatched to Esbjerg; but the legitimate hinterland of the port was more extensive. Among the commodities handled we may note pork and hams, butter, fish, leather and skins, grain, honey, and live animals. (Honey was an important product of Scandinavia at this time and was, of course, in great demand in an age when sugar, *per se*, was unknown.) These essentially agricultural commodities were destined for export. With regard to live animals, we may notice the particular importance paid to cattle and horses right down to the renaissance (Figure 2). Upon Ribe converged the cattle routes not only of the Cimbrian peninsula; but also of the Danish Isles. The destination of cattle varied according to market prices prevailing in the Low Countries and the Elbe Basin. Farmers from all over Jutland sent their animals to Ribe, which was also a leading center for

Gut macht Dorg.
Ripen
Cur tibi sollicito de pectore cardius exit?
Divitiæ cupidas angunt spinosæ curæ.
In Dörnen bey meem grossen Guth
Vrsach ich, hab nimmer guten muth,
Viel Kümmernüß mein Hertz umbringt.
Reichthumb bricht Schlaf, und Sorgen bringt.

FIGURE 4.—The decaying wealth of Ribe seems to be hinted in the symbolism of this elaborated reproduction of Figure 2. (*In Thesauri philo-Politici pars Septima*. Ripen, 1625.) "Riches break sleep and sorrow bring," runs the last line of the rhyme which is appended.

horse sales. A conservative estimate places the annual exchange of horses at some 8,000. Foreign buyers crowded to Ribe and Kolding to purchase horses, which in an age when they were greatly demanded for military enterprise, constituted one of Denmark's most valuable exports. The hinterland of Ribe as a port extended as far afield as Skåne, with which Danish province there was lively exchange.

Overseas contacts with the west were associated principally with England, the Low Countries, the Elbe estuary, and France. Intercourse with the Low Countries was probably most intense, and as a center of transit for Flanders and Holland, Ribe was preëminent. It had commercial liaisons with Zutfen, Maastricht, Harderwijk, Kampen, Alkmaar, Horn, and Ijessel mouth. Cattle were a major item of export to the Low Countries, where they were fattened upon the polders. (Cf. the wastage of cattle in transit. Sjaelland cattle exporters for example stood in a fundamentally disadvantageous position.) Both from the Rolls of the Public Record Office in London and those of King's Lynn (1303, 1305, 1306, etc.), we learn of England's trade with the Danish port. Ribe merchants and Dutch and German intermediaries conducted direct exchange with King's Lynn and Yarmouth. (Yarmouth seems to have been the principal town for shipping in all England in the mid-fourteenth century. Cf. A. Anderson, *An Historical and Chronological Deduction of the Origin of Commerce*, London, 1764.) Horses and agricultural products constituted the chief exports to England. That earlier contacts preceded the recorded dealings is suggested by the discovery of English coins dating from the thirteenth century in the vicinity of Ribe. French coins of the same period tell of intercourse with Burgundy. (Cf. *Numismatic Chronicle*, 1916, pp. 378–401. Among a hoard of English short cross pennies was discovered a "Gros Marseillais" of Count Charles of Provence [1246–85].) Although there were direct associations with Bordeaux, it is probable that trade with France was conducted principally through Bruges. Imports into Ribe consisted chiefly of luxury goods—of Rhenish and French wines, of spirits from the Low Countries, of English and Ghentish cloth, of salt (cf. Saltegade near Norreport in Ribe recalling trade in this commodity), and (later) tobacco.

Naturally trade in medieval times did not proceed unhindered. Piracy was rife and we have evidence from Hakluyt of English merchantmen bespoiled upon the coasts of Denmark. Chaucer's merchant, who doubtless had dealings with Denmark and the Low Countries

> " . . . wolde the sea were kept for anything
> Betwixe Middelburgh and Orewelle."

The challenge to Ribe came not from lawless freebootery so much as from the organized efforts of the Hanseatic League to control the trade of northwestern Europe. Towards the late Middle Ages, trade tended to creep down the Jutish isthmus to the broad base where the flow of commerce from the North Sea to the Baltic moved between the Elbe and Lübeck. Yet although Ribe suffered a relative eclipse as a result of the trade monopolies of the Staple towns, it maintained its absolute quantity of exchange. As the power of the Hanse declined with the rise of the era of world trading, and the shifting of the economic center of gravity gave to the Atlantic littoral a new interpretation, it seemed that Ribe might be restored to its former elevated status.

A multitude of forces, however, de-

cided that the fate of the city was to be otherwise. Prosperity, therefore, throughout the renaissance was intermittent. The material culture of the city rose indeed to a high level; but it was a final blossoming before the decay. Geographical, human, social, and economic factors combined to humble the proud city. With few exceptions, however, they can all be allied to the great change in geographical values which was the fundamental moving force of the sixteenth and seventeenth centuries. The age of maritime discovery was also the age of material discovery. Sea-going vessels increased in size and maritime routeways experienced a corresponding change. Harbor valuations received a new interpretation. Ribe in particular sustained losses as a consequence of this new translation. The growing tonnage of merchant ships made access to the wharves of Ribe difficult and in the sixteenth century, they were anchoring in the broads between Manö and Fanö. As accessibility diminished both Manö and Röm served as outports for the city. Technical changes in shipbuilding also meant that the Skagen route came into operation to the detriment of isthmian traffic. After the sixteenth century, Dutch mariners used the Skagen route regularly and thus attacked from the rear the hinterland of Ribe. In Skåne and Sjaelland the Dutch found a ready market—when political animosity between Denmark and Holland was in abeyance. Ribe struggled to maintain its ascendancy in the face of changing routeways. Much faith was attached to a project of Christian III, who planned a canal across the Schleswig isthmus, which would compete with the alternate water route to the

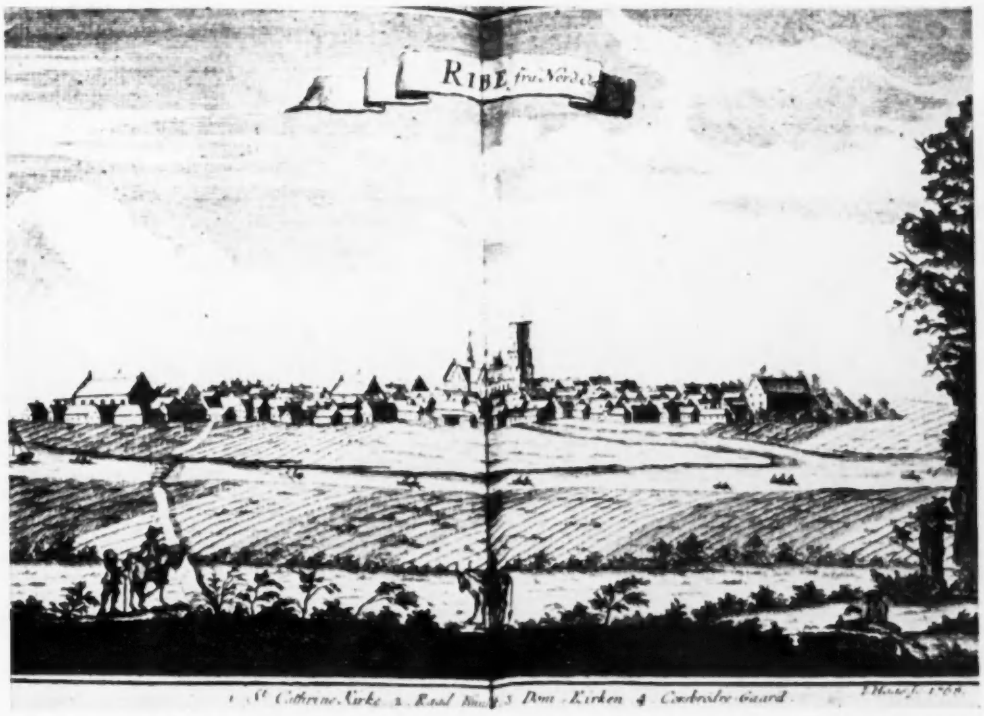


FIGURE 5.—Ribe in the eighteenth century from Pontoppidan's *Danske Atlas*, has shrunk within the confines of its medieval outline. The imposing panorama, which we see in the maps of the "spacious age" has dwindled.

FIGURE 6.—View from Domkirke tower looking seaward. The illustration shows the moated site of the Riberhus and its relationship to the meandering Nipsaa. The narrow streets are focused upon the Domkirke and the urban settlement limited by the definitive lines of the river and the former stronghold.

north and the land route to the south. The artificial waterway was intended to link Ribe with Kolding by way of the Nipsaa and Königsaa—thus bridging the watershed over which portage had proceeded in the Dark Ages. The plan was never put into effect. Natural forces combined with economic forces to strangle the life of the city.

The Nipsaa steadily silted up with a surfeit of sandy deposits—attributable on the one hand to the rapid aging of a river flowing over a gently inclined and unconsolidated plainland; on the other hand to the small, but perceptible, elevation of the coastline over several centuries. (The inhabitants of Ribe naturally attempted to allay this natural process by dredging the Nipsaa consistently during the sixteenth, seventeenth, and eighteenth centuries.) As in the case of the lowlying regions of Holland, natural catastrophes also played havoc with the city in the seventeenth century. The great inundation of 1634 was the precursor to a succession of maritime invasions. A combination of bad land floods, adverse wind conditions, and high spring tide was sufficient to produce critical flooding in the "watten"; but rarely as catastrophic as in 1634. At such times the desolation of the marshland and the destruction of life and property reduced the life of the city to a standstill.

Current political philosophies and social forces also played their part in the decay of Ribe. Mercantilist doctrines intensified the forces promoting the decline, and commercial rivalries between Denmark and her former traders, England and Holland, reduced intercourse to a minimum. But the most disturbing consequence of the exaggerated system of protection which was the offspring of mercantilism, was the rise of smuggling. Spices, tobacco, brandy, spirits, and wines all constituted valuable cargo for contraband. Since the greater part of the trade of seventeenth century Ribe consisted of these commodities, the effects upon the city were marked. Civil dissension within the guilds further weakened its powers of resistance; while the accompaniment to these tendencies was provided by a succession of disastrous fires, e.g. 1508, and epidemics, e.g. 1602, which took their toll upon property and population. The strength of Ribe was sapped and from the leading position which it had held in medieval Denmark, it had declined to a small provincial center by the beginning of the eighteenth century. The changing political fortunes of Denmark, which resulted in a redistribution of territorial ownership in northern Europe after the attenuated wars of the seventeenth century, provided an unfavorable background for a city struggling with so many other contending forces. The year 1660 may be defined as the historical watershed after which Ribe yielded to the superior pressure of natural and economic forces.

Ribe was a settlement predestined by its geography to decline with the birth of the modern age.

The population of Ribe fell to a minimum in the mid-eighteenth century—1827, if we take the authority of Pontoppidan for 1769. The city sank into obscurity. There was only one merchant shipowner who kept alive the old tradition and only the ecclesiasts radiated anything approaching the old atmosphere of wealth and ease (Figure 4).

Today, Ribe has reoriented itself to the Danish economy as the latter has adapted itself to the general scheme of world relationships. Its trade has become the monopoly of Esbjerg, which has also eclipsed it as a regional center. (See ECONOMIC GEOGRAPHY July 1940, in which I have discussed the relationship of the two settlements.) Its principal function today is that of a local market for the products of the surrounding marshes; although it has developed subsidiary industries. It persists as an ecclesiastical center and is evolving a tourist industry. The temporal and spiritual power which it wielded in the Middle Ages has been dissipated. Of the past glory little remains besides the cathedral. But past perils have also disappeared. A diked coastline separates the "watten" from the menacing tides of the North Sea; while the course of the Nipsaa is regulated. The current of world trade flows by Ribe, whose river once brought vitalizing influences from the outer world into the heart of this city.

A geographical conclusion must be drawn. In Ribe, there is an example of a city which has been unable to adapt itself to a changing human interpretation of environment. Adaptation has been prevented by the complex of physical relationships, the modification of which demanded the expenditure of greater human energy than could be afforded by a city located upon the periphery of a declining state power. In the rise of Esbjerg, a fact proving that the demand for commercial intercourse across the neck of Jutland is as powerful as ever, local coastal relationships have been decisive. Since the regional influences which stimulated the former prosperity of Ribe are still active, it seems that topographical position has opposed continuity in the history of Ribe as a commercial center. Traditional forces may enable a settlement to retain certain functions, e.g. ecclesiastical; but the movement of persons and commodities both as regards variety and intensity, is a vital expression of the age and cannot be subjected to restrictive agencies. The shift of the trade of Schleswig from Ribe to Esbjerg is the response of the human agent to a situation in which local values have experienced fundamental changes, but regional values have shown relatively little modification.

FIGURE 7.—Ribe has found a new position in the Danish economy. Similarly, its old buildings house new institutions. Thus the residence crowned by the stork's nest, holds the public library; while the tower in the background indicates a former bishop's palace which is now the post office.

LOCATION OF SALT LAKE CITY

Chauncy D. Harris

SALT LAKE CITY with 150,000 population is the largest city between Denver and the Pacific Coast (Figure 1). It is located near the southeastern shore of the Great Salt Lake on lacustrine terraces at the foot of the Wasatch Mountains (Figure 2). It is favorably placed with respect both to the junction of important routes and to central position in the Wasatch Oasis —a productive irrigated strip which stretches 150 miles north and south at the base of the Wasatch Mountains of northern Utah (Figure 3). (See Mark Jefferson: Utah, the Oasis at the Foot of the Wasatch, *Geogr. Rev.*, Vol. 1, 1916, pp. 346–58, and C. Langdon White: The Agricultural Geography of the Salt Lake Oasis, *Denison Univ. Bull., J. Sci. Lab.* Vol. 21, 1925, pp. 117–283). The fundamental factor in the size of the city is its function as the regional capital for 800,000 people in a section of 185,000 square miles in Utah, eastern Nevada, southern Idaho, and southwestern Wyoming (Figure 2).

The problem of this study is to analyze why the regional capital arose here rather than at some other point. The Snake River Plain of southern Idaho has more irrigation water and hence a greater agricultural output than the Wasatch Oasis. Why did not the regional capital arise there? Ogden, 35 miles north of Salt Lake City, was the junction point of the first transcontinental railroad. Why did it not become the regional capital? Answers to these questions are found in (1) the favorable position of Salt Lake City within the early developed and diversely productive Wasatch Oasis, and (2) the settlement of Salt Lake City as an important pioneer religious capital.

The Wasatch Oasis as a Locating Factor

In the region tributary to Salt Lake City most of the population lives in a few densely settled irrigated areas and mining districts, and much of the land is unpopulated (Figure 4). Under such conditions the logical location for the leading city of the region is within the largest single unit of dense population. The commercial center of that unit would normally be larger than the center of any other cluster and thus if reasonably well located would perform certain regional functions for the lesser areas. Other things being equal, the city would arise also in the earliest developed cluster of population, since a city tends to maintain its position, once it has been established as the leading center in a region.

In respect both to early settlement and to population dominance, the Wasatch Oasis has been particularly favorable. From the very beginning of white settlement, the oasis has been the most important population mass within the Intermontane West. The first large white settlement was made here in 1847. In 1870, nearly twenty-five years later, this single oasis contained more people than the states of Montana, Wyoming, Idaho, and Arizona combined. In more recent years numerous other agricultural areas and mining districts have developed, but to this day the Wasatch Oasis remains the most populous compact unit between the Rocky Mountains and the Sierra

Nevadas. Even with the omission of Salt Lake City, the oasis still contains more than a third of the people in the region tributary to that city, although the oasis includes only one per cent of the area of this region (Figure 4).

Dominance by the oasis in population is based on its outstanding position in agriculture, transportation, and mining. Without the irrigation agriculture in this oasis, Utah would not be a Utah at all, but rather another Nevada. Without the mining of the oasis, Utah would be similar in many respects to southern Idaho. But Utah is neither a Nevada nor a southern Idaho, for it possesses in the Wasatch Oasis a large area of irrigation agriculture, many important mines, a focal area for transportation, and a dominating capital city. Thus it is to be compared with Colorado. It is suggestive that Salt Lake City and Denver, the chief regional capitals between the Middle West and the Pacific Coast, both lie within outstanding areas of irrigation agriculture, at transportation nuclei, and adjacent to rich mining districts.

The initial agricultural preëminence of the Wasatch Oasis was grounded on resources associated with the contact of the high mountain mass of northern Utah and the adjacent depression, which in Pleistocene times was occupied by Lake Bonneville (Figure 2). (See Frederick J. Pack: Lake Bonneville, *Bull. Univ. of Utah*, Vol. 30, 1939, pp. 1–112 and G. K. Gilbert: Lake Bonneville, *U. S. Geol. Survey Mon. No. 1*, Washington, 1890.) These resources are: topography suitable for early irrigation, water in many mountain streams, favorable temperature conditions, and propitious soil.

The Great Basin stands first among the intermontane areas topographically suited to early irrigation. The Snake, Green, and Colorado rivers are larger than the Great Basin streams, but in their descent from high plateaus to sea level they flow through great canyons, from which the pioneers could not readily divert water. The Great Basin streams in flowing toward interior drainage base levels remain at high altitudes. Consequently, their lower courses are not deep canyons but shallow valleys, from which irrigation water could be diverted by simple pioneer tools.

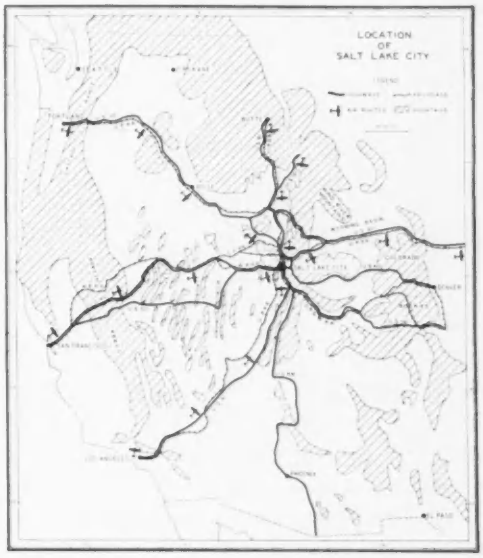


FIGURE 1.—Salt Lake City is the transportation hub of the western United States. Its central position is emphasized by the convergence of railroads, highways, and air lines.

Within the Great Basin area of favorable topography the Wasatch Oasis is distinguished from all other areas by its magnificent array of streams. Thirty-five important streams flow from the Wasatch Mountains into the oasis (see Ralf R. Woolley: Water Powers of the Great Salt Lake Basin, *U. S. Geol. Survey Water Supply Paper No. 517*, Washington, 1924). These streams irrigate about 500,000 acres within the oasis proper (Figure 2). They irrigate slightly more land than all streams in the entire state of Nevada and twice as much as the Sevier River and its tribu-

taries, the second largest stream group in the Great Basin. That the Wasatch Oasis receives the best supply of irrigation water appears to be related to the following factors.

First of all, the high relative relief of the Wasatch Mountains helps to explain their heavy precipitation. These mountains loom up as a great north-south fault-scarp wall overlooking and dominating the valley to the west. Several mountains and plateaus of southern Utah rise to equal or greater heights, but they are not bordered immediately on the west by the broad low basin of ancient Lake Bonneville, now occupied in part by the Great Salt Lake. The net rain-catching relief of the Wasatch Mountains therefore is the highest in Utah.

The position of the Wasatch Mountains as the northernmost range in Utah also is significant, because precipitation rises from south to north with increasing distance from the horse latitudes. The effects of this greater precipitation is exaggerated, because irrigation depends not on the total mountain precipitation, but only on the fraction which enters stream run-off. Under low rainfall, such as occurs on the lower ranges, there is little or no useful run-off, but as precipitation becomes heavier, a larger fraction enters the streams. Thus the mountains east of the Wasatch Oasis form the only area in Utah in which the average annual run-off exceeds twenty inches (U. S. National Resources Board: Report, December 1, 1934, Washington, 1934, map facing p. 300). Since snowfall also is heaviest and persists longest on the northern mountain ranges of Utah, stream flows here continue until relatively late in the irrigation season.

Water available to the oasis in creeks flowing from the Wasatch Mountains is supplemented by rivers from the Uinta Mountains, the highest mountain mass in Utah. In fact, the three largest streams of the oasis, the Weber, Provo, and Bear rivers, rise in a small area on the western flank of the Uintas to flow through or around the Wasatch Mountains.

In addition to abundant water, the Wasatch Oasis has favorable temperature conditions. The area near the Great Salt Lake has an annual average of more than 150 days without killing frost (U. S. Department of Agriculture: Atlas of American Agriculture, Climate, Frost and Growing Season, Washington, 1917–36, p. 38). No other part of the Great Basin in Utah has such a long growing season. This beneficial warmth appears to be due chiefly to the low relative elevation of the basin once occupied by Lake Bonneville (4,000–5,000 feet). The presence of the Great Salt Lake doubtless has some moderating effect, although the importance of this factor has never been measured satisfactorily. In addition, air drainage lengthens the growing season by as much as 30 days on the Lake Bonneville terraces (Marion Clawson et al.: Types of Farming in Utah, *Utah Ag. Exp. Sta. Bull.* No. 275, Logan, 1936, pp. 18 and 53).

Another agricultural resource of the Wasatch Oasis is the variety of well-drained fertile soils on the Lake Bonneville terraces. These soils vary from light easily-worked gravels and sandy loams on terraces, through rich silt loams on lower terrace slopes, to clay loams on valley bottoms. The most striking terraces of Lake Bonneville are in the Wasatch Oasis, because the chief streams which carried delta-building sediments issued from the Wasatch Mountains.

In transportation as in agriculture the Wasatch Oasis attained an early leadership which has persisted. The

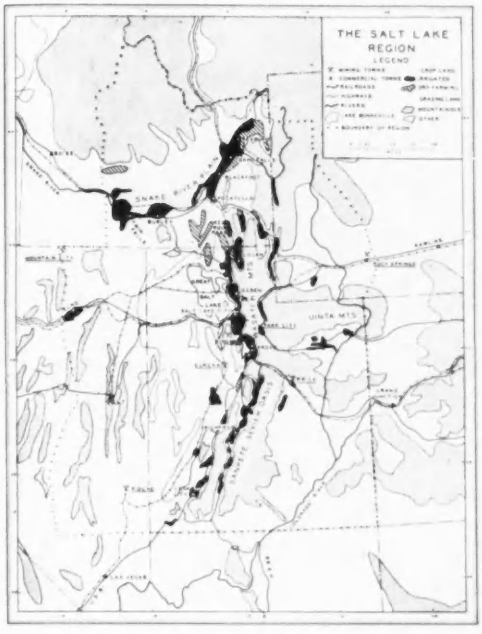


FIGURE 2.—The region tributary to Salt Lake City is made up of irrigated oases, mining camps, and grazing land.

first transcontinental railroad was built over a central route and thus came logically through the oasis which is centrally located in the Cordilleran section of the United States. No other significant area stands so nearly equidistant from the Canadian and Mexican borders and from the Rocky Mountains and Sierra Nevadas. The routing of this railroad was further focused on the oasis by the Wyoming Basin, which offered a relatively low gap between the Colorado Rockies on the south and the Wind River Mountains on the north. Moreover, the Humboldt River directly west of the oasis provided a low-level path through the many north-south ranges of Nevada.

Today the oasis is a hub of railroads, highways, and air lines (Figure 1). All parts of the West may be reached more easily from it than from any other single area. Railroads radiate in six directions. The Union Pacific has lines east to Omaha, north to Butte, northwest to Portland, and southwest to Los Angeles. The Denver and Rio Grande Western runs east to Denver. Both the Southern Pacific and the Western Pacific connect the oasis with Oakland. Highways similarly radiate westward to the three parts of the Pacific Coast, east through Wyoming and Colorado, north to Idaho and Montana, and south to Arizona. Air lines focus on the oasis from north, central, and south Pacific Coast, and from Montana to join the main route east through Wyoming.

In mining as in agriculture and transportation the Wasatch Oasis is outstanding. The mining area on the southern periphery of the oasis is the leading non-ferrous metalliferous mining area in the United States. In 1937 the production of this area exceeded the total mineral production of any other Mountain State and the total non-ferrous metal production of any state in the Union, excepting only Arizona, which has no single area of comparable importance. Approximately two billion dollars worth of metal has been produced by the mines of this area. The well-known open-cut copper mine at Bingham is the largest single working. It lies 27 miles southwest of Salt Lake City on the eastern slopes of the Oquirrh Mountains, which here form the western edge of the Wasatch Oasis (Figure 3). Like Butte, its only serious rival in the United States, Bingham originated as a gold camp in 1863, but now yields chiefly copper, though some lead, zinc, silver, and gold are produced. Park City, the center of a silver-lead district, lies 31 miles southeast of Salt Lake City on the east slope of the Wasatch Mountains. Eureka is the center for a declining silver district to the south. These three districts produce about 99 per cent of the metals of Utah. Although these mining districts are

intimately associated with the Wasatch Oasis, it should be noted that the agriculture and mining are physically separate. In the mining districts of the peripheral mountains, topography and climate are unfavorable for agriculture; within the rich agricultural valleys, recent alluvial and lacustrine deposits mask the underlying solid rock and prevent exploration for useful minerals.

The importance of the oasis in the rise of a regional capital is due to the association of agriculture, transportation, and mining as well as to their individual importance and early development. The presence of an agricultural area capable of early pioneer utilization has furnished an enduring population base from the earliest settlement. The location of the first transcontinental railroad through the oasis encouraged the rise of specialization and exchange. The railhead cities in the oasis were particularly important, since the oasis was then overwhelmingly the most populous area in the Mountain States. The coming of the railroads made possible also the development of mining, for without railroad transportation few of the mineral deposits could have been utilized. In turn the enormous mineral production of the area furnished the railroads with much of their freight and encouraged the construction of railroads converging on the oasis. The specialized mining towns have stimulated the rapid growth of a large commercial center, but it is the agricultural communities which have helped to give this center a measure of stability and permanence. By virtue of the early development and present leadership of the Wasatch Oasis in associated agriculture, transportation, and mining, and consequently in population, the oasis naturally contains the largest and most active commercial center in the Intermontane West. Within the region only the Snake River Plain has more irrigated land than the Wasatch Oasis, but the relatively recent irrigation in the former was not developed until long after Salt Lake City had assumed commanding regional leadership. Furthermore, the Snake River Plain lacks the urbanizing influence of rich mines and focal transportation.

Several sites within the Wasatch Oasis are suitable for the regional capital. Each of the five segments of the oasis is served by a town of some importance—Provo, Salt Lake City, Ogden, Brigham City, and Logan. Any one of these valley centers conceivably might have become the chief center of the oasis and thus of the region (Figure 3). The median point of farm population in the oasis, however, lies between Ogden and Salt Lake City, but closer to the latter. Insofar as the commercial center at first served chiefly farmers, its most likely location would be in the area between these cities. But within this central area localizing factors for the development of a city are lacking. From this area there are no routes through the mountains east nor across the Great Salt Lake west (Figure 3). Weber Canyon and Parleys Canyon, the two mountain-pass routes which most closely approach this area from the east, lead to Ogden and Salt Lake City respectively. The routes to the west pass from Ogden either around the north end of the Great Salt Lake or across the Lucin cut-off and from Salt Lake City around the south end of the lake. With respect to centrality and transportation layout, therefore, Salt Lake City and Ogden occupy the most favorable sites within the Wasatch Oasis. Pioneer settlement largely determined which of these was to be the site of the principal city. This settlement also accounts for the distinctive func-

tions of Salt Lake City as a religious capital.

PIONEER SETTLEMENT AS A LOCATING FACTOR

The Mormon pioneers chose Salt Lake City for the site of their chief city. This selection was significant in part because it made that city the first in the region; it was even more significant because the city then became the organizing center from which the Mormon Church directed most of the early settlement of the region. In the thirty years after 1847, some 70,000 immigrants from Europe as well as many Americans were brought to Salt Lake City for settlement in the city or in its region (Milton R. Hunter: Brigham Young: Colonizer, *Pac. Hist. Rev.*, Vol. 6, 1937, p. 347). Church leaders in Salt Lake City determined the location of the various villages in the region, the composition and leadership of the settlers in each village, and even the form of settlement in villages rather than on dispersed farmsteads. Furthermore, the church was the most powerful economic and social agency in early days. Since the church dominated early settlement and since Salt Lake City was the headquarters of the church, this city since its very founding has been the principal center of the oasis and the region.

The importance of religious settlement is revealed by the fact that the region tributary to the city corresponds closely to the religious hinterland of the city, i.e., the area in which Mormons form a significant portion of the population. The relationship of the regional capital to its region is so intertwined with the rôle of the city as a religious center, that an explanation of the location of the city entails an analysis of the Mormon decision to settle in the region and on the site of this particular city.

As a result of persecution, the Mormons decided to abandon their previous home in Nauvoo, Illinois, and to seek an isolated haven. The reports of Fremont and other explorers were studied for information on western areas suitable for settlement. Because attractive localities in California and Oregon were being rapidly occupied by other Americans, the Mormons chose the desert solitude of the Great Basin. The area near the Wasatch Mountains ("Basin of the Great Salt Lake or Bear River Valley") was early chosen as the best area within the desired isolation of the Great Basin.

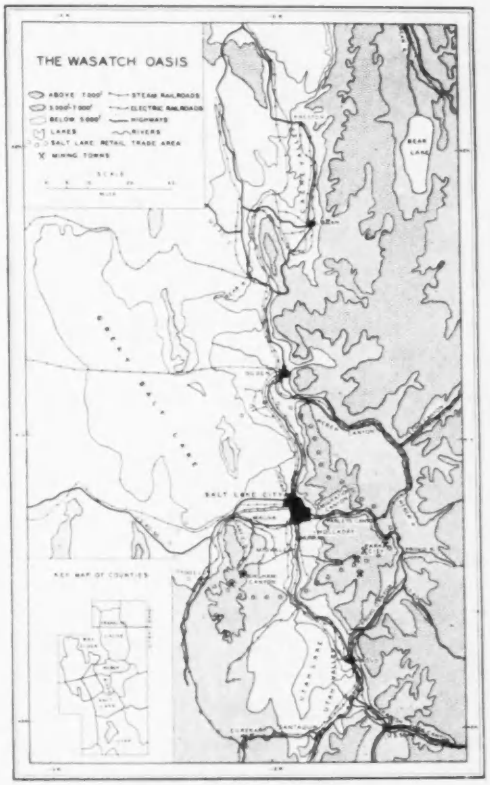


FIGURE 3.—The heart of the Salt Lake Region is the Wasatch Oasis, a narrow band extending 150 miles at the base of the Wasatch Mountains. Closely-spaced railroads and highways serve the irrigated farms and the nearby mining districts.

During the migration west in 1847 Brigham Young and his advance guard obtained additional information on the different sections of their chosen area. Six diary accounts tell the story of the choice of the particular section for initial settlement (William Clayton: William Clayton's Journal, Salt Lake City, 1921. Norton Jacob: "The Life of Norton Jacob," MS in Brigham Young University Library, Provo, Utah. Orson Pratt: Private Journal of Orson Pratt, *Millennial Star*, Vols. 11–12, 1849–50. Erastus Snow: From Nauvoo to Salt Lake in the Van of the Pioneers, *Improvement Era*, Vols. 14–15, 1911–12. Wilford Woodruff: History of His Life and Labors as Recorded in His Daily Journals, 2nd ed., Salt Lake City, 1916. For detailed references to the diaries see Chauncy D. Harris: Salt Lake City, A Regional Capital, Chicago, Private Edition, University of Chicago Libraries, 1940, pp. 95–106). Two informants gave glowing accounts of Bear River Valley and Cache Valley in the northern part of the area, but others said these were too cold (Figure 3). The pioneers consequently rejected that section in the hope of finding a warmer climate near the Great Salt Lake or Utah Lake. Favorable accounts of fertile Utah Valley at the south were offset by fear of the troublesome Indians reported by both Fremont and Bridger. The pioneers knew of two passes through the Wasatch Mountains to the remaining central area east of the Great Salt Lake: Weber Canyon, leading to the site of Ogden, and Emigration Canyon, leading to the site of Salt Lake City (near Parleys Canyon in Figure 3). It was extremely difficult to get wagons through the Weber Canyon gorge, which was later followed by the transcontinental railroad. Since this route was closed by high water at the time, the pioneers followed the Emigration Canyon route. An advance party was sent ahead to select a temporary camp and to plant seeds. The camp was located near the mouth of Emigration Canyon barely four miles within Salt Lake Valley.

Immediately after entry into the valley, the pioneers planted crops and began explorations which according to the pioneer diaries brought to light the following resources: Most important was the water in the many small creeks flowing from the Wasatch Mountains. These streams made possible the practice of irrigation, which is necessary for agriculture in the arid Great Basin. Since the streams came from the Wasatch Mountains, they were confined to the east side of the valley; both the western part of the valley and Tooele Valley immediately to the west were found to be too dry for large irrigation settlements. Because of the gentle slope of the land most of the streams could be utilized without elaborate dams or lengthy canals. The rich, easily-worked loams of the eastern side of the valley were found to be replaced by infertile salty lands just north of the temporary camp on City Creek and by less fertile soils west of the nearby Jordan River. Similarly, the luxuriant grasses of the east side of the valley changed to poor salt marshes beyond City Creek and to sage brush in the western part of the valley. In addition the settlers were impressed with game in the vicinity, with fish in Utah Lake to the south, with salt in the Great Salt Lake, and with hot springs just north of Salt Lake City. The last-mentioned resource supplied a welcome treatment for the travel-weary pioneers. Finally, the climate of the new home seemed mild and salubrious and the moderating influence of the Great Salt Lake was considered important. The observations of the pioneers thus pointed

clearly to settlement on the east side of Salt Lake Valley.

The temporary camp appeared to be as well-placed as any other point in the valley. Since the pioneers had desired to keep as distant as possible from the Indians near Utah Lake to the south, this camp had been located on City Creek, the northernmost of the streams in Salt Lake Valley. Moreover, because this creek divided into two branches on the valley floor, the water from it could be easily diverted for the irrigation of a relatively wide area. Consequently, at an open-air meeting under a full moon on the evening of Wednesday, July 28, 1847, the pioneers voted to make their temporary camp the site of the new city. Temple Square, the center of the settlement, was laid out between the two branches of City Creek.

The Mormon pioneers rightly chose the Wasatch Oasis as the most promising area within the Great Basin. Their choice of a location for their city was based on factors which are not of importance today; the northern valleys are not really too cool for agriculture and the Indians of the south have long since disappeared. These factors, however, turned the pioneers to the central part of the oasis; the great significance of that central position apparently was not then recognized. Within this central area the city was located near the pass which at that time was most useful.

There are, of course, two important passes to this central portion of the oasis; one was easier for a pioneer wagon route, but the other was better for the railroad. Some writers have focused attention solely on the railroad route. It will be recalled, however, that in terms of central location and transportation layout, there are two favorable locations: those of Salt Lake City and Ogden. Although Salt Lake City is three times as large as Ogden, the latter has been an aggressive rival and is three times as large as any remaining city in the region.

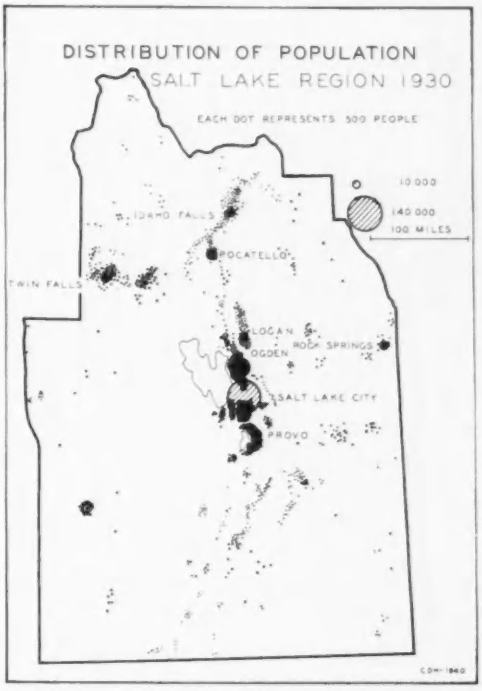


FIGURE 4.—The population is concentrated chiefly in the farming areas of the Wasatch Oasis and the Snake River Plain. Most of the area is without permanent inhabitants.

Transportation facilities as they developed stimulated first one city and then the other. The pioneer wagon road led to Salt Lake City. Except for the difficulty of the Weber gorge the impetus of original settlement and subsequent roads might have been given to Ogden.

The builders of the first transcontinental railroad blasted a route through the difficult gorge of Weber Canyon, because the antecedent (or perhaps superposed) river provided a much lower elevation through the Wasatch Mountains (Figure 3). The possibility of two routes to the west found expression in the controversy as to whether the railroad should be built around the north or the south end of the Great Salt Lake. Early plans had called for routing the railroad down

Weber Canyon, thence south to Salt Lake City and around the south end of the lake (George Leslie Albright: Official Explorations for Pacific Railroads 1853–55, *Univ. Calif. Publ. Hist. No. 11*, Berkeley, 1921, p. 96). If the transcontinental railroad had been so constructed, it would have passed through Salt Lake City with the result that Ogden today might be little more than a small town. The railroad, however, was built around the north end of the lake, for this route was found to be about 30 miles shorter to Humboldt Wells, a controlling point in Nevada. Thus Ogden benefited by routes both to the east and to the west and received a powerful impact as the junction point of the first railroad. If settlement of the area had not preceded the building of railroads, Ogden probably would have become the regional capital.

Later developments have tended to favor Salt Lake City. The Denver and Rio Grande Western Railroad gave Salt Lake City an independent route to the east in 1883 and the associated Western Pacific Railroad furnished a direct route to the west in 1910 (Figure 1). Furthermore, modern highways lead chiefly to Salt Lake City, since the main routes from the east converge on that city to meet the highway around the south end of the lake to the central Pacific Coast. There is no comparable highway west from Ogden. The air lines too have come to Salt Lake City, since it is the largest city of the region.

The rise of mining has favored Salt Lake City, for all important mines of the oasis lie south of this city. The mining population in the oasis is so important that if the population of Salt Lake City and Ogden be ignored, the median point of population for the oasis now lies just south of Salt Lake City. Thus even if Ogden had become the first settlement, the railroad center, and the regional capital, a secondary city in Salt Lake Valley would have been encouraged by the rise of mining, the large farm population in the southern part of the Wasatch Oasis, and the bi-focal aspect of oasis transportation.

The dominance and early settlement of the Wasatch Oasis and its nicely balanced pattern of passes make it clear that either Salt Lake City or Ogden might have become the chief city of the oasis and thus the regional capital. The critical factor in the dominance of the former is its pioneer settlement as the headquarters of the Mormon Church.

BOOK REVIEWS

PARKER, MARGARET TERRELL. *Lowell: A Study of Industrial Development.* The Macmillan Company, New York, 1940. Price $2.25.

Lowell, Massachusetts, is a city which owes its existence to its mills. Its early spectacular growth was characterized by expanding industries and increasing population, and no other American community of purely industrial origin has been a city for a whole century. However, for the past two decades the city has experienced a serious decline characterized by changing industries and a resultant decrease in population. This is illustrated by the fact that employment decreased sixty per cent between 1918 and 1936

The object of the study is "to portray the city as it is today, to analyze the environmental factors involved in its evolution to its present status, and to consider problems which its future development presents." Certainly, these objectives have been attained. Although originally presented as a Ph.D thesis in Geography, the author sometimes gets well into the fields of economics and sociology when explaining and interpreting some phases of local life and activities. This broad deviation is permissible as the author has thoughtfully suggested a subtitle that permits a wide variation from the geographical factor.

There are four important, but unequal parts of the study: (1) Lowell today, (2) the evolution of the pattern, (3) factors in industrial use and decline, and (4) future possibilities. The first two are largely descriptive and historical in character. The third section is not only the longest but represents the major contribution to the problem, for it first considers the various factors of production for the city as a unit and secondly for the individual textile industries and other types of manufacturing. In conclusion it is suggested that Lowell may emerge from this crisis as a smaller city, but a smoothing out of the present cost differentials will at least prevent further migration of industry to regions now offering lower taxes and lower wages to the mill owner. This goal cannot be attained easily and will require the coöperation of all who are concerned with the future welfare of the city.

The treatise is supported by well documented statements and by evidence of direct field observation. It also contains numerous detailed maps and interesting photographs as well as a complete bibliography and an adequate index.

The book constitutes a thorough study of the rise and decline of one of our problem industrial cities. It is not just an urban study, but attempts to solve a problem which is facing the remaining population of Lowell. Undoubtedly the same problem is facing other cities in the so-called American manufacturing belt. Certainly no student of urban or industrial geography can fail to be interested in this book, which is, more-or-less, a pioneer attempt in a much neglected phase of economic geography.

A. D. CUTSHALL

OREGON STATE BOARD OF HIGHER EDUCATION, *Physical and Economic Geography of Oregon.* 319 pages, illustrated, 7½ x 10½, paper covered. Oregon, 1940. Price $2.00.

This useful compendium of information on the State of Oregon was prepared by a committee of ten persons of whom Warren D. Smith, Professor of Geography at the University of Oregon, was chairman. In all, 34 authors connected with various institutions of higher learning in the state collaborated in the preparation of the manuscript. The book is attractively printed and illustrated and while the style of writing varies with the author, it is on the whole excellently prepared.

After taking up the natural background and the physical framework of Oregon the natural regions are discussed. The regions recognized are Coast Range, Willamette Valley, Cascade Plateau, Klamath Mountains, Southeastern Lake district, Columbia-Deschutes Plateau, Blue-Wallowa Mountains, and the Snake River Province. Next, the climate, soils, flora, and fauna are discussed. The people are described in three chapters, one on the aboriginal life and its response to the natural environment, followed by Oregon history and a discussion of the population of Oregon, its distribution and characteristics. The chapter on agriculture in Oregon is the longest in the book with contributions from a large number of specialists, edited by M. N. Nelson, Agricultural Economist of Oregon State College. Numerous maps and diagrams are valuable additions to this chapter. Nearly five million acres of improved land are found in 64,182 farms in Oregon, agriculture supporting more people than any other industry in the state. While forest and wood products are the most important manufacture, being worth about $180,000,000 per annum, manufactured goods worth $120,000,000 derive their materials from agriculture. Under manufacturing a special chapter is devoted to lumbering in addition to a general chapter on the forest resources. Other contributions describe min-

erals, power resources, transportation, and scenic features.

On the whole the *Physical and Economic Geography of Oregon* will be found an exceedingly useful reference work on the state. It is better adapted for that purpose than as a textbook in the subject. The compilation of factual material has been carefully done. Teachers using the book will find it necessary, however, to supplement textual matter with discussions on the factors affecting certain industries and resources and geographic relationships. The book will be found exceedingly valuable for reference and supplemental reading in research projects. It would be highly desirable for other states to follow the lead of Oregon in a similar compilation on their geography.

The book may be purchased through the Coöperative Bookstore at either the University of Oregon at Eugene or the Oregon State College at Corvallis.

O. W. FREEMAN

WHITBECK, R. H., AND FINCH, V. C. *Economic Geography*, new fourth edition. McGraw-Hill, New York, 1941.

Since the publication of the outstanding text in economic geography by Whitbeck and Finch in 1924, the whole field of the subject has been reorganized as a consequence of that first edition. In subsequent editions the authors have substantially improved upon the material, upon the method of treatment, and upon the efficiency of presentation of their subject in each successive edition, until this fourth edition constitutes such an important improvement over the first that there is little chance for comparison. The first issue was so superior to anything that had appeared up to that time that it immediately preëmpted the field, and how successful and how valuable the book has been is indicated by the many successive editions and the demand for them.

Since the senior author, Prof. R. H. Whitbeck, died in July, 1939, the task of revision has fallen upon the junior author, V. C. Finch, who is fully qualified and competent to take upon his own shoulders this difficult task of revision in so difficult a time as the world faces at present, when the whole system of production and distribution and consumption has been disrupted by the exigencies of war. As he states in the preface to this latest edition, "Devastating as war may be in its influence on production and trade, it does not greatly alter the inherent capacities of the world's regions to produce. Therefore, the basic elements of land, energy, and resources, and the complexities of their regional association may still be discussed with some assurance." Finch has a simple, direct and easy style that helps to make the interesting material he presents, all the more interesting.

The new fourth edition covers the same field in much the same way as the earlier editions, but greater stress has been placed upon regional contrasts without sacrificing the essential integrity and unity of the material. The substance of the text, and its geographical quality have been augmented by new and significant material both statistical and descriptive. Not only does the new fourth edition measure up to the standard of the earlier editions, but it surpasses them in interest, in attraction, and in value.

W. E. E.

LIGHT, RICHARD UPJOHN, AND MARY. *Focus on Africa*. American Geographical Society, Special Publication No. 25, New York, 1941.

Eighteen years have slipped by since the American Geographical Society issued from its press in conjunction with the National Research Council "The Vegetation and Soils of Africa," by Homer L. Shantz and C. F. Marbut, with a rainfall map of Africa by J. B. Kincer, and a classification of the land of Africa by the joint authors; and now it renders another great service to the cause of African science and African economics by publishing another truly remarkable book, "Focus on Africa." This latter volume is larger, and certainly more interesting to the general public, though perhaps not more valuable.

The former volume was strictly professional and technical, a basic contribution to an understanding and appreciation of Africa and African conditions. The authors of that earlier volume were both scientific men of the first rank, leaders in their respective fields, and by their joint endeavors contributed to the knowledge of the so-called "Dark Continent" the first comprehensive and fundamental survey of some of the most important features of the African environment, the natural vegetation and the soils.

The latter volume "Focus on Africa" gives flesh and blood and life to the skeleton which the earlier book constructed. The two books together constitute a most impressive compendium of the geography of Africa that can be obtained anywhere. Neither one of the two volumes is a textbook. One, the later, is a running account of Africa as it really is, as it is seen from the air and from the ground; the other, the earlier, describes the stage upon which the great drama of life and history is being enacted. The two complement each other in a most valuable way.

"Focus on Africa" is a happy combination of travel book, geographic reference book, and a book of adventure. It combines all three elements so well that there is continuity and unity throughout the presentation of the material. The text is written in a fluent, easy style that is easy to follow, and so clear that error

or ambiguity is completely eliminated. The text is by Dr. Richard Upjohn Light, no doubt assisted by his capable wife, Mary Light, who accepts the responsibility, and deserves the utmost praise, for the splendid photographs which so generously illustrate and illumine the volume. The book is a record of a long flight in a "Bellanca" airplane from Corsica to Tunisia, along the coast of Libya and Egypt to Cairo, up the Nile to Uganda and Kenya to Zanzibar, and thence across Tanganyika, Mozambique and the several states of the Union of South Africa to Cape Town, traversing almost every province and state of eastern Africa.

We need another such book as this "Focus on Africa" for the Atlantic states and provinces of the great continent, and then we shall have a pretty satisfactory picture of Africa as it is today. Of course the details can be filled in by many similar books on more limited areas, and these books will come in due time. The literature on Africa has increased many-fold in the last quarter century, as the very excellent bibliography at the end of the book under review indicates.

Not only are the authors to be congratulated upon the splendid work that they have done and the splendid book that they have produced, but the American Geographic Society deserves a great meed of praise for having made available to its members and to the public at large this really superb book. Like all the volumes issued in the course of the years under the sponsorship of the American Geographical Society, "Focus on Africa" is very well bound, and printed in a clear legible type upon superior paper. It is carefully and painstakingly edited by Dr. Gladys M. Wrigley, Editor of the *Geographical Review*. As Special Publication No. 25, of the American Geographical Society, "Focus on Africa" reflects credit upon the Society, upon American science as represented by geography, and upon the authors and the editor.

W. E. E.

HAAS, WILLIAM H., Editor. *The American Empire*. xi and 408 pages. Published by The University of Chicago Press, Chicago, 1940. Price $4.00.

With the growing fear of possible axis penetration into Central and South America evidenced by the recent acquisition of new American air and naval bases in the Caribbean, and with the rising tension in the Far East reflected in the tardy decision to fortify Guam, it is of distinct value to have presented in this single volume, "The American Empire," the salient facts concerning the outlying possessions of the United States. Prof. William H. Haas and his associates have produced a scholarly and readable narrative beginning with a brief account of the era of American overseas expansion and closing with a thoughtful appraisal of that shibboleth, "Manifest Destiny," under which the United States "has grown great and powerful . . . without inflicting serious injustice upon any other nation." Despite the familiar charges of "dollar diplomacy" and "American imperialism," our conduct as a colonizing nation has been on the whole exemplary, and although mistakes have been made, no one can deny that our intentions at least have been good. But it is another matter to determine if our subject peoples are now the better or the worse for having come under our supposedly beneficent rule. On this score Prof. Haas and his colleagues in sober objective prose unfold a record sprinkled with disappointment, for the American flag has not by any means meant prosperity to all nor has it brought an end to all economic ills in our colonial domain.

Puerto Rico presents a sad situation. It is an island of contrasts, in which dignified Spanish architecture faces garish signs advertising American automobiles, while beggars sit in rags before the elaborate entrances of local branches of foreign banks. It is an island where public health measures only serve to intensify the major problem of overpopulation. For Puerto Rico has too many mouths to feed, and it is "only in a reduced and a stationary population" that the people of the island can "look forward with assurance to maintaining a decent standard of living." Sugar-cane production, the leading industry, is antisocial: its blessings fall upon a limited group, largely absentee and foreign, unsympathetic with the problems of the landless native worker. The outlook for coffee is discouraging and the hurricane is an ever-present menace to all crops. Despite the millions of dollars invested in Puerto Rico, the American administration "has done comparatively little for the social and economic betterment of the poorer classes." Grim poverty and limited opportunity have kindled discontent culminating in vigorous demands for changes political and economic. The Puerto Rico Reconstruction Administration and more recently the national defense program have brought some relief, but the outlook remains dark and uncertain.

East of Puerto Rico lie the Virgin Islands of the United States. Wisely refraining from the usual tales of bloodthirsty pirates and buried treasure, Dr. Shaw gives instead an excellent survey of the economic factors in the present-day situation of St. Thomas, St Croix, and St. John. St. Thomas has a magnificent harbor and a beautiful hotel, but most tourists stay in the port only a few hours, buy a little rum, a few souvenirs, and then return to sleep on board the cruise ship. In spite of heavy expenditures by the government-sponsored Virgin Islands Company in St. Croix, the success of sugar is definitely limited by the uncertain rainfall. Only in St. John, primitive as it is, has there been a somewhat satisfactory adjustment of the population to the means of sub-

sistence. "Large expenditures and small receipts," writes Dr. Shaw, "emphasize the liability quality of these Caribbean white elephants." Yet they were purchased chiefly for their strategic value and since their former owner, little Denmark, is at present completely occupied by German troops, who would deny the comfort in knowing that they are now under our flag and not liable therefore to seizure by a totalitarian power? But economically, though Dr. Shaw is perhaps a bit too pessimistic, it may be doubted if the Virgin Islands can ever be made a paying proposition.

The northland of Alaska remains "a land of exploitation" and in the aggregate it has been a neglected possession, into which comparatively few have gone to settle permanently. It is not the gold but the fisheries, particularly salmon, which today constitute the most important source of wealth in Alaska. The Matanuska colonization project, if it succeeds, may point the way to the development with federal funds of similar areas. But to farm in Alaska one must have the spirit and the stamina of the pioneer, for the growing season is short, the soil is generally poor, and the available market is limited.

Hawaii is the one bright spot among our insular possessions. Blessed with natural beauty and a kindly climate the Hawaiian Islands have become an ideal playground. Indeed, "the business of catering to visitors is regarded as the third industry of the territory, ranking next after the production of sugar and pineapples." The population is mixed, with a numerous oriental contingent, and one may wonder if all the diverse national and racial elements of Hawaii can be eventually assimilated into one united people. At the moment of course with possible war brewing in the Pacific, the importance of the Hawaiian Islands as an air, naval, and military base can scarcely be overestimated. From the strategic outpost of Hawaii to the west and to the south across the broad Pacific lie such islands as Wake, now being used as an airplane base and yet uninhabited until 1935, and Guam and American Samoa, both important naval bases. But our largest island domain in the Pacific is the Philippines Taken from Spain by the fortunes of war, pacified by the United States army, and governed in a benevolent fashion of which Americans can be proud, the Filipinos are soon to be set adrift in a predatory world. How long they can stand alone, how soon they will fall victim to Japanese economic penetration, only time can tell.

As one reviews the story of our overseas expansion one lesson stands out: possessions while conducive to national pride are rarely a source of profit. One must agree with the authors in their opinion that even if we received the British and French West Indies "as an outright gift," economically we would be the loser. Prof. Haas and his associates occasionally slight the political factors in our colonial empire, and they disappoint by failing to show more precisely how it is and has been governed. There is, for instance, no adequate mention of the valuable work of the former Bureau of Insular Affairs, the early records of which are now available in The National Archives. Economic and geographic factors are, however, given due consideration. It is unfortunate that the publisher has not seen fit to provide the book with good maps, without which the general reader is likely to find himself at a loss in following the text.

HAROLD LARSON

HUNTINGTON, ELLSWORTH. *Principles of Human Geography.* Fifth Edition Largely Rewritten. John Wiley & Sons, Inc., New York, 1940.

The Fifth Edition of Huntington's "Principles of Human Geography" appeared in 1940. Like the earlier editions it deals with man's geographical relationships, man's relation to the earth as a globe, the fundamentals of climate, continents and oceans, physiography and human progress, man's relations to soil and minerals, man's relation to climate, man's regional relationships, and finally man's relationship to man. It is not so much a strictly human geography, as it is a general geography with emphasis upon man, the generally accepted point of view of modern geography. Like most of Huntington's books it lays upon the shoulders of climate a pretty heavy burden of responsibility for what man is and does, and this may not be at all amiss.

It is needless to review the material of this valuable textbook or to comment upon its educational value; both are too well known to need any further elaboration or support. For more than twenty years since the issue of the original edition in collaboration with Sumner W. Cushing, Huntington's "Human Geography" has dominated the field. It still remains one of the best, perhaps the best, textbooks in the field and deserves the leadership it has achieved.

W. E. E.